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NEW HOGAN DAM AND LAKE CALAVERAS RIVER, CALIFORNIA

WATER CONTROL MANUAL

APPENDIX III TO
MASTER WATER CONTROL MANUAL
SAN JOAQUIN RIVER BASIN, CALIFORNIA

US Army Corps of Engineers
Sacramento District

JUNE 1983

NEW HOGAN DAM AND LAKE

CALAVERAS RIVER, CALIFORNIA

WATER CONTROL MANUAL

APPENDIX III

To

Master Water Control Manual

San Joaquin River Basin, California

JULY 1983

Department of the Army
Sacramento District, Corps of Engineer
Sacramento, California

NEW HOGAN DAM AND LAKE

PERSONNEL CONCERNED IN THE OPERATION OF NEW HOGAN RESERVOIR

	UNIT	OFFICE PHONE	NAME	HOME PHONE
PROJECT OFFICE VALLEY SPRINGS, CALIFORNIA	NEW HOGAN RESERVOIR	209-772-1343 (VALLEY SPRINGS)	R. L. HOLTZ PARK MANAGER	209-772-2237 (VALLEY SPRINGS)
DEPARTMENT OF THE ARMY SACRAMENTO DISTRICT CORPS OF ENGINEERS SACRAMENTO, CALIFORNIA	DISTRICT ENGINEER	916-440-2232*	COL. A. E. WILLIAMS DISTRICT ENGINEER	
	RESERVOIR CONTROL SECTION	916-440-3405* 916-440-3167* 916-440-3168*	R. A. NEAL CHIEF	916-791-0478 (ROSEVILLE)
		916-440-3475*	R. L. LUNDEEN	916-483-0388
	HYDROLOGIC FACILITIES	916-440-2112*	J. T. JOHNSON	916-685-6135
	OPERATIONS BRANCH	916-440-2327*	M. L. HELM CHIEF	916-961-1918
		916-440-2305*	A. E. SMITH, JR. CHIEF, OPERATIONS & MAINTENANCE SECTION	916-652-5280
U.S. BUREAU OF RECLAMATION SACRAMENTO, CALIFORNIA	MID-PACIFIC REGION	916-484-4571	J. GRAHAM REGIONAL DIRECTOR	
	CENTRAL VALLEY PROJECT OPERATIONS	916-484-4213	D. TUCKER CHIEF, CENTRAL VALLEY OPERATIONS COORDINATING OFFICE	916-967-8793
		916-484-4585	B. LINK CHIEF, WATER OPERATIONS BRANCH	916-481-7911
	CENTRAL VALLEY OPERATIONS COORDINATING OFFICE (NIGHTS AND HOLIDAYS)	916-484-4672 (SACRAMENTO)	POWER SYSTEM DISPATCHERS	
IRRIGATION INTERESTS	STOCKTON EAST WATER DISTRICT P.O. BOX 5157 STOCKTON, CALIFORNIA 95205	209-948-0333 (STOCKTON)	J. D. BEARD II GENERAL MANAGER E. REMINGTON WATERMASTER	209-957-6549 (STOCKTON) 209-887-3110 (LINDEN)
	WATER TREATMENT PLANT	209-948-0537 (24 HR)	OPERATOR ON DUTY	

FTS: SACRAMENTO 448-2000; STOCKTON 467-8011
NOTE: BETWEEN 4:30 PM AND 7:45 AM, OR ON SATURDAY, SUNDAY OR HOLIDAYS USE 916-452-1535 (FLOOD SEASON ONLY)

NEW HOGAN RESERVOIR, CALAVERAS RIVER, CALIFORNIA REV. 15-JUNE-83

NEW HOGAN LAKE
CALAVERAS RIVER, CALIFORNIA

PERTINENT DATA

General

Drainage areas	
Mormon Slough at Bellota	470 sq mi
Calaveras R at Jenny Lind	393 sq mi
Cosgrove Cr near Valley Springs	21.1 sq mi
Calaveras R at New Hogan Dam	363 sq mi
S Fk Calaveras R near San Andreas	118 sq mi
N Fk Calaveras R near San Andreas	85.2 sq mi
Flows at dam site	
Mean annual (1907-1980)	157,300
Max. mean daily recorded inflow (23 Dec 55)	24,000 cfs
Max. instantaneous recorded inflow (2 Apr 58)	42,000 cfs
Standard project peak inflow	66,000 cfs
Standard project peak outflow	28,000 cfs
Spillway design peak inflow	132,000 cfs
Spillway design peak outflow	118,000 cfs

Reservoir

Elevation	
Inactive pool	586 ft
Flood control pool (bottom)	666.17 ft
Gross pool	713
Taking line	720 ft
Spillway design flood pool	720 ft
Area	
Inactive pool	702 acres
Gross pool	4,333 acres
Spillway design flood pool	4,670 acres
Storage capacity	
Inactive pool	14,900 ac-ft
Flood control pool (bottom)	152,100 ac-ft
Gross pool	317,100 ac-ft
Standard project flood pool	322,300 ac-ft
Spillway design flood pool	348,600 ac-ft
Reservoir length at gross pool elevation	8 miles

Spillway (gated, ogee)

Location	in saddle near left abutment
Crest length	114 ft
Crest elevation	679.5 ft
Total excavation	176,000 cu yds
Total concrete	12,000 cu yds
Gates (Tainter) number & size	3-38'0"x36'0"
Head at gross pool	33.5 ft
Head at spillway design flood pool	40.5 ft
Maximum capacity (SDF pool)	106,400 cfs

Outlet works

Total excavation	41,000 cu yds
Total concrete	18,900 cu yds
Intake elevation, invert	534.5 ft
Effective head at gross pool (approx)	171.5 ft
Effective head at inactive pool (approx)	44.5 ft
Reinforced concrete conduits through dam	
number and size	4-5'8"x10'0"
Gates, number and size	
Service, (hydraulic slide)	4-5'8"x10'0"
Emergency, (hydraulic slide)	4-5'8"x10'0"
Discharge capacity (full gate opening)	
at inactive pool, elev 586 feet	7,450 cfs
at pool elev 667.6	12,500 cfs
at gross pool elev 713 feet	14,600 cfs

Hydroelectric power facilities — None

Control structure — Reinforced concrete control chamber located approximately 140 feet upstream of dam axis. Access by reinforced concrete gallery from downstream portal of conduit

Main dam (rock & earth fill)

Elevation, top of dam	725 ft
Freeboard, above spillway design flood pool	5 ft
Maximum height	200 ft
Length of crest	1,960 ft
Width of crest	20 ft
Width of roadway	16 ft
Upstream slope	1 on 2.0
Downstream slope	1 on 1.6
Total excavation	133,000 cu yds
Total volume of embankment	2,465,000 cu yds

Dike No. 1 (earth fill)

Elevation, top of dike	725 ft
Freeboard, above spillway design flood pool	5 ft
Length of crest	370 ft
Width of crest	20 ft
Width of roadway	16 ft
Maximum height	10 ft
Upstream slope	1 on 3.5
Downstream slope	1 on 3.5
Total excavation for dike	1,700 cu yds
Total volume of embankment	6,100 cu yds

Dike No. 2 (earth fill)

Elevation, top of dike	725 ft
Freeboard, above spillway design flood pool	5 ft
Length of crest	535 ft
Width of crest	20 ft
Width of roadway	16 ft
Maximum height	18 ft
Upstream slope	1 on 3.5
Downstream slope	1 on 3.5
Total excavation for dike	3,800 cu yds
Total volume of embankment	13,500 cu yds

Dike No. 3 (earth fill)

Elevation, top of dike	725 ft
Freeboard above spillway design flood pool	5 ft
Length of crest	310 ft
Width of crest	20 ft
Width of roadway	16 ft
Maximum height	10 ft
Upstream slope	1 on 3.5
Downstream slope	1 on 3.5
Total excavation for dike	1,800 cu yds
Total volume of embankment	5,500 cu yds

Dike No. 4 (earth fill)

Elevation, top of dike	725 ft
Freeboard above spillway design flood pool	5 ft
Length of crest	140 ft
Width of crest	20 ft
Width of roadway	16 ft
Maximum height	10 ft
Upstream slope	1 on 3.5
Downstream slope	1 on 3.5
Total excavation for dike	400 cu yds
Total volume of embankment	900 cu yds

Old Hogan outlets — centerline elevations

One — 36" diameter pipe	539.85' msl
4 — 5'6" diameter holes	552.85' msl
3 — 5'6" diameter holes	579.85' msl
1 — 5'6" diameter holes	595.85' msl
1 — 5'6" diameter holes	609.35' msl
Overflow crest elevation	633.35' msl

NOTICE TO USERS OF THIS MANUAL

Regulations specify that this Water Control Manual be published in looseleaf form, and only those sections, or parts thereof, requiring changes will be revised and printed. Therefore this copy should be preserved in good condition so that inserts can be made to keep this manual current.

NEW HOGAN DAM AND LAKE
CALAVERAS RIVER, CALIFORNIA

WATER CONTROL MANUAL

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1-01. AUTHORIZATION

The New Hogan Dam and Lake Water Control Manual, Calaveras River, California, is an Appendix to the San Joaquin River Basin Master Water Control Manual. It is prepared in accordance with instructions contained in ER 1110-2-241, EM 1110-2-3600, EC 1110-2-208, and ETL 1110-2-251.

1-02. PURPOSE AND SCOPE

This manual provides a detailed plan for water control and management at the New Hogan Dam and Lake project on the Calaveras River, California. A map of New Hogan Lake area is shown on Plate 1. Location of the project is shown on Plate 2.

1-03. RELATED MANUALS AND REPORTS

This manual is Appendix III to the San Joaquin River Basin Master Water Control Manual. Other related reports are as follows:

Manuals

Title	Date
Master Manual of Reservoir Regulation, San Joaquin Basin, California	Jul 54
Appendix I - (reserved for Cosumnes River)	
Appendix II - Camanche Dam and Reservoir	Sep 81
Appendix III - New Hogan Dam and Lake	Jul 83
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Appendix XI - Friant Reservoir	Aug 80
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Appendix XIII - (reserved for Redbank-Fancher Creeks Projects	
Appendix XIV - Los Banos Reservoir	Oct 70

Related Reports

Maintenance Manual	16 Feb 66
Review of Spillway Adequacy	Nov 78

Design Memoranda

Title	Date
No. 1 - Hydrology	7 Oct 57
No. 2 - Real Estate	4 Feb 59
No. 3 - Relocations	17 Jun 58
Supplement No. 1	
No. 4 - Dam and Appurtenances with Appendices A, B and C	18 Jun 59
Supplemental No. 1	18 Jun 59
No. 5 - Administration and Utility Buildings	(Withdrawn)
No. 6 - Reservoir Regulation	1 Apr 59
Supplemental No. 1	14 Jun 63
No. 7 - Preliminary Recreation and Management Plan	28 Aug 59
Supplement No. 1, Initial Public Use Facilities	23 Jun 61
No. 8 - General Design	21 Jan 60
Supplement No. 1	7 Jul 60
No. 9 - Tainter Gates	1 Jun 60
Supplement No. 1	1 Jun 60
No. 10 - Reservoir Clearing	5 Dec 60
No. 11 - Master Plan	11 Apr 62
No. 12 - Operator's Quarters and Fallout Protection	4 Feb 63
No. 13 - Supplemental Initial Facilities, Deer Flat and North Shore Areas	2 Jul 63
No. 14 - Real Estate - Land Requirements for Access Purposes	7 Jul 66
No. 15 - Deer Flat Interim Boat Access Development	7 Jul 69
No. 16 - Master Plan	21 Oct 77
No. 17 - Visitor Interpretive Center	

1-04. PROJECT OWNER

New Hogan Dam and Lake is owned by the U.S. Army Corps of Engineers.

1-05. OPERATING AGENCY

The Sacramento District, U.S. Army Corps of Engineers operates the New Hogan project. Duties related to the control of outflows are performed by the Park Manager or by a designated Damtender. The Park Manager has a normal tour of duty at the dam of eight hours per day, five days a week. At other times, the Park Manager may be contacted at his residence at the project. Project personnel will be on duty weekends and holidays and at other-than-normal working hours as necessary for effective project operation.

1-06. REGULATING AGENCIES

The plan of operation of New Hogan Dam for flood control was developed by the Corps of Engineers, Sacramento District, with the objective of securing the greatest possible benefits from flood control, irrigation, municipal and industrial water supply, and recreation. Water stored in flood control space, including water stored above the maximum flood reservation in accordance with the antecedent precipitation - ground wetness index, is subject to the discretionary control of the Sacramento District.

Objectives and plans for the management of water stored outside the flood control reservation were jointly developed by the Stockton East Water District (formerly the Stockton and East-San Joaquin Water Conservation District), the State of California Department of Water Resources, and the U.S. Bureau of Reclamation. The Stockton East Water District normally coordinates the day-to-day conservation releases with the Park Manager. The conservation water supply contract is administrated by the Bureau of Reclamation, Mid-Pacific Region, Sacramento.

II - DESCRIPTION OF PROJECT

2-01. LOCATION

New Hogan Dam and Reservoir are located on the Calaveras River, near Valley Springs, California, about 28 miles east of Stockton, California. The location of the project relative to the Calaveras River Basin and relative to California are shown on Plate 2, a general map of the basin. The project can be reached by car by driving east from Stockton on State Highway 8/26, or east from Lodi on State Highway 12.

2-02. PURPOSE

New Hogan Lake provides storage for flood control, municipal and industrial water supply, irrigation, and recreation.

2-03. PHYSICAL COMPONENTS

New Hogan Dam is a combination rock and earthfill structure with a maximum height of 200 feet and a length of 1,960 feet. Four earthfill dikes with a maximum height of 18 feet and a total length of 1,355 feet are located in small saddles on the periphery of the reservoir. The elevation of the top of the main dam and dikes is 725 feet, providing 5 feet of freeboard above the spillway design flood pool at elevation 720 feet. Plans, elevations, and sections of dam and dikes are shown on Plates 3-5.

At normal full pool (elevation 713.0 feet), the reservoir extends about 8 miles from the dam in a northeasterly direction, and about 3 miles from the dam in a southerly direction, for a total length of about 11 miles. The capacity of New Hogan Lake at normal full pool was originally estimated at 325,000 acre-feet, but sedimentation and a more accurately developed area capacity table has reduced it to about 317,100 acre-feet. The area at normal full pool is about 4,300 acres. Area and capacity curves are presented on Chart A-1, and a table of capacities is presented on Chart A-2.

Outlet works are provided for ordinary flood control and irrigation releases, and for all releases for pool elevations below the spillway crest. The outlet works are located in the left abutment of the main dam, and consist of: an intake structure; a control chamber; a rectangular concrete conduit of four 5'8" x 10'0" barrels; and a chute and flip bucket type of energy dissipator. The gate control section of the outlet works houses four pairs of 5'8" x 10'0" slide gates operating in tandem. One of each pair is used in normal service; the other is provided for emergencies. A plan, profile, and sections of the outlet works are shown on Plate 6, and outlet rating curves are shown on Chart A-3.

A gated spillway with a concrete, ogee crest is provided to protect New Hogan Dam from overtopping during rare, extremely large floods. The spillway is located in a saddle 600 feet south of the left abutment of the dam. Spillway flows are controlled by three 38 feet by 36 feet tainter gates with two intervening piers, each 8 feet wide, giving a gross crest length of 130 feet and a net length of 114 feet. The crest is at elevation 679.5 with the invert of the approach channel at elevation 671.5 and the top of gates

elevation is 714.5. The approach channel, approximately 300 feet long, converges from 400 feet wide at the entrance to 130 feet at the control section. A concrete chute with a width of 130 feet and constant slope of 0.115 conducts the flow from the ogee section to a flip bucket approximately 214 feet downstream from the crest. A double lane access bridge across the spillway provides for maintenance and operation of the spillway and serves as a link with project roads. A plan, elevation, and sections of the spillway are shown on Plate 7, and a spillway discharge rating curve is shown on Chart A-4.

2-04. RELATED CONTROL FACILITIES

Hogan Dam is a reinforced concrete arch structure located 600 feet upstream from New Hogan Dam. It was built for flood control by the City of Stockton in 1930. Its gates have been removed and its interference with flow to New Hogan Dam is negligible.

The Mormon Slough Project, Calaveras River, is a system designed to convey Calaveras River flood flows safely through the highly productive agricultural lands downstream of New Hogan Dam and through suburban Stockton. The Mormon Slough Project was authorized by Congress in 1962 and completed in 1969. The system consists of a diversion of the Calaveras River near Bellota to Mormon Slough, then to the Stockton Diverting Canal to the east side of Stockton, then back to the Calaveras River through Stockton, as shown on the General Map on Plate 2. The Mormon Slough project authorized enlargement of the capacities of the Calaveras River between the Mormon Slough Diversion and the Stockton Diverting Canal, but this improvement was dropped as economically unfeasible. The design capacity of the system is 12,500 cubic feet per second. This provides protection to adjacent lands from flooding in about 80 to 84 percent of all years. The system is maintained by the San Joaquin County Department of Public Works. The Stockton East Water District operates several irrigation and municipal-industrial diversion facilities on Mormon Slough and on the Calaveras River below the New Hogan project. Stockton East's principal municipal-industrial diversion facilities are located near Bellota and consist of the Calaveras River Headworks, Bellota Weir, and the municipal-industrial intake.

The Calaveras River Headworks consist of four reinforced concrete culverts with 4-foot square openings and slidegates on the upstream end. The structure limits flood flows and controls irrigation flows down the river. The channel capacity in the reach below is severely restricted due to its small cross section and dense overgrowth on its banks.

The Bellota Weir, located on Mormon Slough just downstream of the Calaveras River Headworks, is a removable check dam (flash boards and stanchions) with flow control slide gates located on the face of the dam. The crest is normally 8 feet above the channel. During the summer when diversion flows are greater and there is no danger of flood flows, the effective height of the weir is increased to raise the head on the Calaveras River Headworks and the municipal-industrial intake.

The intake to Stockton East Water District's municipal-industrial water supply system is located just upstream of the Bellota weir, downstream from the Calaveras River headworks. The design capacity of the intake and conveyance system is 93 cubic feet per second. Water diverted to the intake

is conveyed 13.3 miles via a 54-inch diameter underground concrete pipe to Stockton East's treatment plant. The current plant capacity is one-half the headworks capacity, with provision for constructing additional capacity.

The Stockton East Water District's other facilities are mainly small flash board dams on the Calaveras River, Mormon Slough, and Mosher Creek to facilitate the operation of irrigation pumps.

2-05. REAL ESTATE ACQUISITION

Project lands comprise a total 6,342 acres with 6,064 acres acquired in fee, 180 acres transferred from the U.S. Bureau of Land Management, and 98 acres in flowage easement at the upper end of the lake. A map of project boundaries is shown on Plate 8.

2-06. PUBLIC FACILITIES

The Corps of Engineers has developed public recreation at the New Hogan project. The main recreation developments are on the north shore. They include campgrounds, picnic areas, boat launching ramps, a marina, access roads, parking areas, and water supply and sanitation systems. An observation-visitor center is located near the project offices near the right abutment of the dam. Table 1 presents a tabulation of recreational facilities, and Plate 9 shows their locations.

The Corps of Engineers has financed all of the recreation facilities except for the marina, which was developed with private funds by a concessionaire, and expansion of boat launching facilities in fiscal year 1976, which was accomplished with a contribution from the California Department of Navigation and Ocean Development.

Recreation uses account for about 2,900 acres of project lands. About 1,700 acres are leased for horse and cattle grazing.

TABLE 1

RECREATION FACILITIES

			Restroom Fixtures					Boat Launching		Parking	
Area	Camp Unit	Picnic Unit	Flush	Vault	Portable	Water	Trash Cans	Lane	Marina	Car	Car+ Trlr
Oak Knoll											
Campground	75				18	X	X				
Youth Camp	group				4	X	X			X 1/	
North Shore											
Campground	121		30			X	X				
Day use area		171		12	10		X	10	1	100	248
Observation			4			X				35	
Deer Flat	30				6		X				

1/ Informal parking.

III - HISTORY OF PROJECT

3-01. AUTHORIZATION

The New Hogan project was authorized by the Flood Control Act of 1944 (Public Law 534, 78th Congress, 2d Session) substantially in accordance with the recommendations of the Chief of Engineers in House Document Number 545, 78th Congress, 2d Session.

The project was modified by House Document Number 367, 81st Congress, 1st Session, in accordance with a report dated, 1 July 1948, entitled "Preliminary Definite Project Report, Hogan Reservoir, Calaveras River, California, Alternative Plans of Improvement," approved 30 September 1948 by the Office of the Chief of Engineers. This report recommended construction of an earth dam and reservoir with a 325,000 acre-feet normal full pool capacity.

Development and management of the reservoir land and water area resources for public recreation are authorized by Section 4 of the Flood Control Act of 1944, as amended.

3-02. PLANNING AND DESIGN

Planning and design of the New Hogan Lake Project were accomplished by the U.S. Army Corps of Engineers, Sacramento District, and reviewed by authorities at higher levels, including the Office of the Chief of Engineers in Washington, D.C. The Sacramento District's studies considered single and multi-purpose reservoirs at the site. The final design represented maximum net benefits, measured in dollar costs and benefits, given the flood control and water supply operation objectives.

The original plan was presented in House Document Number 545, 78th Congress, 2d Session, which contained the report and recommendations of the Chief of Engineers. The plan entailed raising the existing Hogan Dam to provide 237,000 acre-feet normal full pool capacity, with 162,000 acre-feet of flood control space during the flood season. The objective for flood control was to limit flows in the Calaveras River to 7,000 cubic feet per second. This objective flow would have been exceeded twice in the nearly forty years of record at the time, even with no outflow from Hogan Dam, because of inflows originating below the dam. Subsequent studies indicated that a 325,000 acre-feet normal full pool capacity would be necessary to meet an increased irrigation demand, and an earthfill dam was found necessary to provide the additional storage. At the same time, it was determined that a downstream channel capacity of 12,500 cubic feet per second would be required to control the flow originating below the dam during the Standard Project Flood, and therefore adoption of the 12,500 cubic feet per second as the project downstream flow objective was recommended. This recommendation and the changes associated with increasing the storage capacity of the project were officially adopted in 1948. Adoption of the new flood control objective flow meant downstream channel capacities would need improvement. The Mormon Slough Calaveras River project, which accomplished the need for these improvements, was authorized by Congress in 1962.

3-03. CONSTRUCTION

Construction of New Hogan Dam and appurtenances began in November 1960, and was completed by June 1964. Impoundment of water began in November 1963. The total cost was about $16.9 million.

Initial recreation facilities were developed in 1962. Campground enlargements were completed in 1968. Additional boat launching facilities were completed in January 1976.

3-04. RELATED PROJECTS

The Mormon Slough Calaveras River project consisted mainly of channel enlargements and realignments on Mormon Slough and the Stockton Diverting Canal below New Hogan Dam to increase their capacity to the reservoir operation design objective of 12,500 cubic feet per second. The project was authorized by Congress in 1962. Construction began in September 1967, and was finished in September 1968.

3-05. MODIFICATIONS TO REGULATION

The required flood control reservation at New Hogan is variable from January through June, depending on antecedent precipitation, in order to increase irrigation and municipal-industrial water supply yield by allowing less-than-maximum reservation when the basin is relatively dry and, consequently, less runoff would be anticipated. The relationship between antecedent precipitation and flood control reservation has been modified periodically, based on operating experience and further studies; changes were made in 1975 and again in 1983.

Another change made in 1983 was the addition of a release schedule to specify realistic flood control releases based on experienced or anticipated inflow and the amount of flood water already stored in the flood control reservation.

The Stockton East Water District's municipal and industrial water supply system is operating at near system capacity during the summer months. Since 1978, this added demand has resulted in full use of the conservation yield of New Hogan.

3-06. PRINCIPAL REGULATION PROBLEMS

One problem experienced in operation of the New Hogan Lake Project is bank erosion and sloughing due to flood control releases. Damages are minimized by proper maintenance, bank protection in critical areas, and limitations on the rate at which releases from New Hogan Lake can be changed.

Another problem is related to carry-over of water in flood space until the end of the flood season to increase the project's conservation yield without compromising flood control operations. A reliable and accurate long-range weather forecast would make carry-over possible, but until then carry-over storage will continue to be short-term, based on the antecedent precipitation index for expected loss rates and runoff. This scheme is intentionally biased in favor of flood control to minimize flood risk.

IV - WATERSHED CHARACTERISTICS

4-01. GENERAL CHARACTERISTICS

The area associated with operation of the New Hogan Lake Project is basically the entire Calaveras River Basin, including its distributory channels, flood plain, and service area.

The Calaveras River Basin above New Hogan Dam is relatively low-lying, consisting of 363 square miles on the western slope of the Sierra Nevada in Calaveras County, California. The basin is fan-shaped in plan, with five principal tributaries. Esparanza Creek and Jesus Maria Creek, which together form the North Fork of the Calaveras; and Calaveritas Creek, San Antonio Creek, and San Domingo Creek which form the South Fork. The North and South Forks join about 7 miles above the dam, within the limits of the reservoir. Below New Hogan Dam, the Calaveras flows westerly to emerge from the foothills at Bellota, where the channel divides into two branches. A control structure provides for diversion of water when desired into the old Calaveras River channel, which is narrow and overgrown with dense vegetation. Otherwise flows enter Mormon Slough which was enlarged in the late 1960's to convey 12,500 cubic feet per second. Mormon Slough extends 13 miles southwesterly across the valley floor to the Stockton Diverting Canal, which continues northerly on the east side of Stockton to rejoin the Calaveras channel. From there, the Calaveras extends westerly through the City of Stockton to the San Joaquin River on the west side of Stockton. A General Map of the basin is presented on Plate 2.

4-02. TOPOGRAPHY

Above New Hogan Dam, the Calaveras River drains 363 square miles of foothill and moderately mountainous terrain on the lower western slope of the Sierra Nevada, with parallel ridges separating the principal tributaries. Elevations range from 550 feet at the dam to about 6,000 feet at the highest point. The distribution of area according to elevation for the basin above the dam is presented in Table 2 below.

TABLE 2

AREA DISTRIBUTION BY ELEVATION
CALAVERAS RIVER BASIN ABOVE NEW HOGAN DAM

Elevation Range (feet)	Percent of Area
550-1,000	10
1,000-2,000	47
2,000-3,000	30
3,000-4,000	8
4,000-5,000	4
5,000-6,000	1
TOTAL	100

From New Hogan Dam to Bellota the Calaveras Basin is 110 square miles in area, consisting primarily of foothills. The elevation, ranges down to about 130 feet at Bellota. The 234 square mile flood plain below Bellota is low and flat.

A topographic map of the Calaveras Basin is presented on Plate 10. Stream profiles of the Calaveras and its larger tributaries as well as the flood conveyance system on the flood plain are shown on Plate 11.

4-03. GEOLOGY, SOILS, AND VEGETATION

The geology of the Calaveras River Basin from Bellota to the highest elevation is characterized by meta-sediments and meta-volcanics rock structures of the mesozoic age overlain in planes by tertiary sediment and volcanics. Large granite outcroppings are visible in the highest elevations. The immediate area around New Hogan Lake consists of Mariposa formation and Copper Hill volcanics of Upper Jurassic age. There is no known active fault line in the vicinity of New Hogan Dam.

Soils in the upper elevations are typicaly fine textured meta-volcanic residual of moderate depth and good drainage. Lower, in the vicinity of the dam, soils are residual derived from meta-sedimentary slate and schist, from meta-basic igneous rocks from granitic rock, and from volcanic conglomerate. Most are moderately shallow to very shallow, generally loamy, and range from neutral to slightly acid or acid. Most soils are of coarse fragments, and rock outcrops are common. Soils on the valley floor are deep and moderately well-drained to well-drained and are favorable for agriculture.

Vegetation above Bellota consists principally of grasses, brush and scattered oaks, with heavy conifers at higher elevations. Above New Hogan Dam, vegetation is distributed as shown on Table 3 below.

TABLE 3

DISTRIBUTION OF VEGETATION
ABOVE NEW HOGAN DAM

Description	Elevation Range (feet)	Percent of Area
Grassland (and scattered timber)	550-3,000	5.0
Brushlands (chapparral, etc.)	550-6,000	32.0
Deciduous forest (some grassland)	550-6,000	49.0
Light coniferous	1,000-5,000	10.5
Heavy coniferous	2,000-6,000	3.5
	TOTAL	100.0

On the valley floor, orchards and vineyards are common, and other large areas are devoted to row crops. There are also orchards, vineyards, and field crops grown at several locations adjacent to the Calaveras River between New Hogan Dam and Bellota.

4-04. SEDIMENT

Sedimentation rates in the Calaveras Basin are relatively low. Sedimentation transport measured at gages on the North and South Forks indicate a low rate. Sedimentation rates in adjacent basins are low. Furthermore, the general shallowness of soils and nearly complete absence of upstream erosion strongly indicate low sediment loads on the Calaveras River.

4-05. CLIMATE

Climate in the Calaveras River basin is characterized by cool, wet winters and hot, dry summers. Temperatures on the valley floor normally range from a winter low of about 30°F to a summer high of about 105°F and are typical of the entire basin except for the extreme upper elevations. The monthly distribution of average temperatures at representative stations in or near the basin are presented in Table 4, and the locations of the stations are shown on Plate 12.

TABLE 4

TEMPERATURE DATA FOR
SELECTED STATIONS

Month	Normal Monthly Temperature (in degrees F)		
	Stockton WSO Airport	Camp Pardee	Calaveras Big Trees
January	44.6	45.2	36.8
February	49.1	49.2	38.2
March	52.7	52.2	39.7
April	58.6	57.6	44.8
May	65.2	64.1	51.9
June	71.8	71.3	59.5
July	76.7	78.3	67.5
August	75.3	76.7	65.7
September	72.1	73.3	61.4
October	63.5	64.6	52.7
November	52.9	54.3	43.8
December	45.6	46.6	38.5
Mean	60.7	61.1	50.0
Years of Record	27	48	35
Elevation (feet, msl)	22	658	4695

Source: U.S. NOAA, 1941-70.

Normal annual precipitation (NAP) for the watershed above New Hogan Dam is 33.3 inches, and ranges from about 24 inches at New Hogan Dam to nearly 50 inches in the upper basin. In dry years, annual basin

precipitation can amount to less than 11 inches and in wet years more than 40 inches. Plate 12 shows isohyetal lines of NAP over the basin.

More than 90 percent of the annual precipitation occurs from November through April. Plate 13 shows seasonal Variation of Rainfall Frequency. Winter storms, which account for the greatest share of annual basin precipitation, originate over the Pacific Ocean and are associated with frontal systems containing masses of moist air moving inland against mountain barriers. Precipitation usually occurs as rain below 4,000 feet elevation. Above 4,000 feet, precipitation may occur as snow, although winter storms often bring rain above 4,000 feet. Intensities are moderate, but rain generally continues for three or four days and is often followed by additional storm fronts. As much as half of the normal annual precipitation may fall in a single storm period.

Precipitation during summer is from thunderstorms and is mainly confined to relatively small areas at higher elevations.

Average monthly precipitation for three representative stations are shown on Table 5.

TABLE 5

PRECIPITATION DATA AT SELECTED STATIONS

Month	Average Monthly Precipitation					
	Stockton WSO Airport		Camp Pardee		Calaveras Big Trees	
	Inches	%	Inches	%	Inches	%
July	.01	.1	0.01	0	0 06	0.1
August	0.03	.2	0.04	0.2	0.13	0.2
September	0.17	1.2	0.18	0.9	0.51	0.9
October	0.72	5.1	1.15	5.5	2.78	5.0
November	1.72	12.1	2.80	13.4	6.79	12.3
December	2.68	18.9	3.50	16.8	10.17	18.4
January	2.91	20.5	3.85	18.4	10.60	19.1
February	2.11	14.9	2.91	14.0	8.24	14.9
March	1.96	13.8	3.17	15.2	7.99	14.4
April	1.37	9.7	2.25	10.8	5.25	9.5
May	0.42	3.0	0.80	3.8	2.22	4.0
June	0.07	0.5	0.20	1.0	0.64	1.2
Total	14.17	100.0	20.86	100.0	55.38	100.0
Nov-Apr	12.75	89.9	18.5	88.6	49.04	88.6
Years of Record	27		49		35	
Elevation (feet, msl)	22		658		4695	
Basin Mean NAP	33.0 Inches					

Source: U.S. NOAA, 1941-70.

Table 6 presents historical monthly evaporation data for New Hogan Lake.

Table 6

HISTORICAL MONTHLY EVAPORATION
NEW HOGAN LAKE

Month	Evaporation, Inches	
	Mean	Standard Deviation
January	1.2	.19
February	1.5	.18
March	2.7	.40
April	4.0	.94
May	6.3	.80
June	7.9	.75
July	9.9	.60
August	9.3	.83
September	7.6	.72
October	5.3	.64
November	2.1	.37
December	1.2	.29
Total	59.0	

Period: 1965-80

Total wind movement is measured at New Hogan Dam, and daily movements are recorded. Table 7 is a compilation of average monthly wind movement at the dam.

Table 7

HISTORICAL AVERAGE
MONTHLY WIND MOVEMENT
NEW HOGAN LAKE

Month	Wind Movement, Miles	
	Mean	Standard Deviation
January	1,511	339
February	1,405	312
March	1,493	224
April	1,317	241
May	1,213	188
June	1,159	179
July	1,186	190
August	1,182	213
September	1,190	179
October	1,332	239
November	1,269	254
December	1,440	371
Total		

Period: August 1964-October 1980.

Total wind movement is measured at New Hogan Dam, but the nearest station recording instantaneous velocities is at the Stockton Airport. Measurements at Stockton are considered representative of conditions at New Hogan. The maximum velocity observed at Stockton was 46 miles per hour from the SE; this occurred in January 1967. The maximum average 1-hour velocity at Stockton is estimated to be 30 miles per hour. The prevailing direction of winds for Stockton is southwest.

4-06. STORMS AND FLOODS

Rain floods can occur anytime during the period from November through April. This type of flood is usually caused by frontal systems from the Pacific Ocean moving against the Sierra Nevada. Rainfall intensities are generally moderate but prolonged over several days. The resulting floods are usually characterized by high peak flows of short duration, but when antecedent rainfall has resulted in saturated ground conditions or when the ground is frozen, the volume of runoff is much greater and flooding is more severe.

Since the Calaveras River Basin is low-lying, snow and snowmelt runoff are negligible in contributing to flooding.

Thunderstorms lasting up to three hours can occur over small areas at higher elevations from late spring through early fall. The resulting runoff is characterized by high peak flows of short duration with low volumes. For small tributaries, peak flows from thunderstorms can approach those which occur during major winter rain floods, but flows on the Calaveras River are barely affected.

Comparative flows for observed floods since the turn of the century are shown in Table 8 on the next page. It should be noted that damage in the study area during most of the known past floods would have been significantly reduced if the floods had occurred with presently existing flood control facilities completed and in operation.

Quantitative information on flooding in the study area prior to 1900 is practically non-existent. Streamflow records extend from 1907 to the present for the Calaveras River. Descriptive data on flood events since the turn of the century may also be found in newpaper files; the authorization documents for the flood control projects on the Calaveras River; certain of the design documents for these projects; publications of the U.S. Geological Survey and U.S. Weather Bureau (now National Weather Service); and, since 1950, in unpublished post-flood reports prepared by the Corps of Engineers.

Although quantitative data does not exist for historical floods, descriptions of ones in the last half of the 19th Century indicate their large magnitudes. It is recorded that valley floor area of the Calaveras River was entirely inundated during a number of these floods; during floods that occurred in 1861-62, flooding on the valley floor was deep enough to permit riverboats to reach almost any locality in the inundated area.

The major floods that occurred during the earlier part of the 20th Century (March 1907, January 1909, January-February 1911, and January 1921) were all very similar in their impacts. Flooding was widespread, frequently extending entirely across the area between Mormon Slough and the Calaveras

TABLE 8

HISTORICAL FLOODFLOWS

Flood	Peak Flow (a) c.f.s. Mormon Slough at Bellota		Calaveras River at Jenny Lind
March 1907	(b)		34,600
January 1909	(b)		33,000
January-February 1911	(b)		50,000
January 1916	(b)		22,000
February 1917	(b)		31,300
March 1918	(b)		21,800
January 1921	(b)		37,900
February 1922	(b)		24,500
February 1925	(b)		27,500
February 1936	(b)	(37,000)	10,100
February 1938	(b)	(42,000)	10,600
November-December 1950	(9,000)	(23,000)	7,600
December 1955	(16,000)	(33,000)	14,200
April 1958	15,400	(43,000)	12,100
February 1963	6,700	(25,000)	6,900
December 1964-January 1965	3,300	(33,000)	2,600
January 1969	10,700	(20,000)	(c)

(a) Flow values shown in ( ) are estimated. For the Jenny Lind station, estimated peaks remove the effect of old Hogan Dam (1936-1963) or New Hogan Lake (1964 and later); recorded flows are also shown for comparison. All flow values are rounded.

(b) Station not in operation.

(c) Station discontinued.

River in the vicinity of Linden, which was entirely flooded a number of times during the period. Subsequent to construction of the Diverting Canal (1910), floodwater ponded on its north side and extended far to the north and east. The area was frequently described as an inland sea. These floods caused extensive damage and great hardship, and repair, restoration, and recovery created major financial burdens on the county government and on the individuals directly affected.

Subsequent to 1936, the original Hogan Dam and Reservoir had a tempering effect on flooding in the study area. Floods that would have reached major proportions were largely averted by that project in February 1938 and February 1963.

The most widespread and destructive flood of any in the recorded history of the Central Valley occurred in December 1955. Floodwater broke out of the Calaveras River to inundate farmlands in the vicinity of Linden. Mormon Slough breached its levees and flooded along both sides from Bellota to the Diverting Canal. An extensive area north and east of the canal was inundated.

During the 1958 flood, Hogan Reservoir filled and spilled for the first time since its completion. About 3,000 acres of farmlands in the vicinity of Linden were flooded by the Calaveras River where two levee breaks occurred. Linden was threatened but not damaged. Levees along Mormon Slough were breached in a number of locations and about 7,000 acres of land flooded in a strip extending from Bellota to the Diverting Canal. A major levee break occurred near the head of the Diverting Canal. Flooding also occurred on 1,500 acres along the north side of the Diverting Canal.

Widespread flooding occurred in northern and central California and western Nevada in December 1964 and January 1965. Severe storms occurred over the watershed but flooding and flood damage was minimal because the levee and channel improvement project was nearly finished at the time and functioned effectively to prevent significant damage to agricultural and suburban residential developments. New Hogan Lake, which became operational just prior to the flood season, stored runoff from a moderately large flood and controlled flows downstream to non-damaging amounts.

The map on Plate 14 shows the areas which are likely to be susceptible to flooding based on analysis of the hydraulic characteristics of the flood channel and flood plain, and historic flooding. The extent of damages and hazards from any flood on the Calaveras River flood plain depends upon the depth and duration of flooding, velocity of flow, and rate of rise. The condition of levees is an indeterminate factor in flooding. Levee failures were based on the consideration of the present stability of the levees together with past failures. Furthermore, debris often collects against obstructions during floods, causing greater water depths (backwater effect) upstream; however, the occurrence and amount of debris is also an indeterminate factor. As a result, the maps reflect consideration of vegetation normally existing in floodways, and show the backwater effect of the permanent physical features obstructions, but do not reflect increased water surface elevations that could be caused by debris collecting against obstructions. The maps also do not account for future deposition of silt in stream channels or under bridges.

As the map shows floods of the magnitude of the 100-year Flood[1/] and the Standard Project Flood[2/] under present conditions would result in extensive inundation of urban and suburban residential areas, commercial and light industrial areas, and agricultural lands devoted to orchards, row and field crops, and grazing.

Many miles of major surface arteries, county roads, and railroad track would be overtopped and rendered impassable for varying periods, and roadway, bridges, and railroad embankment would be damaged. Existing private and publicly owned levees and improved channel sections would be damaged by erosion and deposition of debris.

The 100-year Flood would inundate a relatively small area Sorth of the Calaveras River and extending west from Highway 99 to the Stockton Diverting

1/ The 100-year Flood is one with a peak flow magnitude that has a 1 percent chance of being equalled or exceeded in any given year.

2/ The Standard Project Flood may be expected from the most severe combination of meteorological conditions, either general rain or cloudburst, reasonably characteristic of the geographic region.

Canal. A Standard Project Flood would additionally inundate a small portion of downtown Stockton; east of Stockton, floodwaters would extend easterly from Highway 99 across the flood plain in narrowing bands. The entire area between Mormon Slough and the Calaveras River, including the community of Linden, would be flooded except for one large and several small "islands." Much of the flooding during either floods would result from overland flows of streams outside the Calaveras basin. There would be intermingling of floodwaters from both sources, and much flooding would be sheet flow (broad, overland flooding) in nature. "Island" areas that cannot be identified using available topographic data would occur in various sectors of the flooded areas. Flooding in the Delta tract section of the study area would resflt only from levee breaks caused by high tides and/or high stream outflow through the Delta region. The number and location of such levee breaks cannot be predicted.

Please see Section 4-12. for a discussion of the economic impacts of flood damage.

4-07. RUNOFF CHARACTERISTICS

Plate 15 presents a tabulation of derived and observed monthly unimpaired inflows to New Hogan Lake for the period 1907-1980. The monthly distribution and statistical characteristics of annual inflows is summarized below in Table 9. Since streamflow regulation in the Calaveras River Basin above New Hogan Lake is negligible, these tabulations represent typical flows that might be expected in the future.

TABLE 9

AVERAGE MONTHLY INFLOWS
TO NEW HOGAN LAKE

Month	Average Inflow In Acre-Feet
October	700
November	3,200
December	14,300
January	35,200
February	40,400
March	36,600
April	19,600
May	6,300
June	2,200
July	800
August	300
September	300
Annual	157,300

Period: 1907-80

4-08. WATER QUALITY

Water quality in New Hogan Lake and in the Calaveras River above and below the lake is sampled semi-annually on a regular basis under the Corps of Engineers, Sacramento District's water quality monitoring program.

Inflows to New Hogan Lake have been of consistently high quality. Lake water is also of generally high quality, although dissolved oxygen decreases to low levels in the hypolimnion (lowest stratum) of the lake during the summer when the lake is stratified. This condition is thought to adversely affect the cold water fishery. Outflow water quality closely parallels lake water quality except that the dissolved oxygen level is higher.

The continuation of good water quality in the Calaveras River is important since it is a main source of the municipal water supply for Stockton. The Calaveras' high quality also permits virtually unrestricted use for crop irrigation. Accordingly, the Sacramento District will continue monitoring Calaveras River and New Hogan Lake water quality.

4-09. CHANNEL AND FLOODWAY CHARACTERISTICS

The design capacity of the Calaveras River, Mormon Slough, Stockton Diverting Canal system is 12,500 cubic feet per second. This corresponds to a gage elevation of 13.6 feet on Mormon Slough at Bellota and 16.4 on the Stockton Diverting Canal. Mormon Slough and the Stockton Diverting Canal are maintained by the San Joaquin County Department of Public Works. Reaches of both channels are protected from erosion with rock riprap. Nevertheless, sections of the channels below Bellota and most of the Calaveras River between Bellota and New Hogan Dam are subject to erosion and bank sloughing even at flows below channel capacity. To minimize sloughing and erosion, changes in New Hogan outflows are limited to 2,000 cubic feet per second in any 2-hour period.

Table 10 is a compilation of reach lengths and flood wave travel times in the lower Calaveras system.

TABLE 10

REACH LENGTHS AND FLOOD WAVE TRAVEL TIMES

Reach	Length (Miles)	Approximate (a) Travel Time (Hours)
Calaveras River, New Hogan Dam to Bellota	17.8	3
Mormon Slough, Bellota to Stockton Diverting Canal	13.4	2
Stockton Diverting Canal	4.9	1
Calaveras River, Stockton Diverting Canal to Mouth	5.2	1

(a) Approximate travel times for flows near 12,500 cubic feet per second.

4-10. UPSTREAM STRUCTURES

There are no significant upstream structures.

4-11. DOWNSTREAM STRUCTURES

See Section 2-04. for a discussion of diversion structures.

4-12. ECONOMIC DATA

Lands in the Calaveras River flood plain are very productive and extensively cultivated. They are used primarily for orchards, vineyards, and irrigated row and field crops. Some areas are devoted to stock raising and dairying, but these activities are much less important than crop production, particularly peaches, cherries, and walnuts. Sugar beets are the most important field crop of the area. Improvements in rural flood plain areas primarily comprise those associated with orchards and include extensive facilities for irrigation. Commercial development outside of Stockton is largely limited to retail establishments and recreational enterprises located near several subdivisions and numerous single-family rural residences near Stockton. Light industrial development is primarily related to farming, and consists of facilities for packing, shipping, warehousing, and transporting agricultural products, and merchandising and storing agricultural chemicals. Linden is the shipping point for an important cherry, walnut, and peach growing region.

Surface transportation facilities consist of two local railroads, a branch line of the Southern Pacific Railroad, three major highways, and a network of county roads. Stockton is indirectly served by the Stockton Deep Water Ship Channel and by major airlines that maintain scheduled flights to Stockton Metropolitan Airport.

Stockton is a major population center oriented to serving surrounding agriculture with manufacturing, food processing, finance, transportation, warehousing, communications, government, and retail commerce. Populations for several local political areas are shown in Table 11. Tables 12 and 13 indicate the value of agricultural activities in the region.

TABLE 11

POPULATIONS OF SELECTED AREAS

Region	Population 1960	1970	1978
Calaveras County	10,300 (a)	13,600 (a)	18,200 (a)
San Joaquin County	250,000 (a)	291,000 (a)	313,700 (a)
City of Stockton	86,300 (b)	102,700 (b)	131,100 (a)
Stockton Metropolitan Area		291,100 (c)	

Sources:
(a) California Statistical Abstract, 1979.
(b) California Statistical Abstract, 1970.
(c) 1980 Commercial Atlas and Marketing Guide, Rand McNally and Co., 1980.

TABLE 12

GROSS VALUE OF COMMODITY GROUP PRODUCTION
BY COUNTY, 1975

Commodity Group	Gross Value of Agricultural Production ($1,000) San Joaquin	Calaveras
Field Crops	138,935	2,360
Seed Crops	8,036	0
Vegetable Crops	99,098	10
Fruit and Nut Crops	108,302	447
Nursery and Cut Flowers	10,455	15
Apiary Products	655	3
Livestock	17,103	3,937
Livestock Products	64,166	52
Poultry	5,125	1,226
Poultry Products	28,667	0
TOTALS	480,542	8,540

Source: Gross Values of California's Agricultural Production By Counties and Commodity Groups, 1974 and 1975, California Crop and Livestock Reporting Service, 1976.

TABLE 13

GROSS VALUE OF THE FIVE MAJOR CROPS
GROWN IN SAN JOAQUIN COUNTY, 1975

Crop	Gross Value ($1,000)	Percent State Total
Tomatoes	62,315	10.9
Grapes	34,265	6.1
Sugar Beets	30,574	11.3
Market Eggs	28,667	9.0
Barley	8,350	5.4

Source: Gross Values of California's Agricultural Production By Counties and Commodity Groups, 1974 and 1975, California Crop and Livestock Reporting Service, 1976.

At present, the area outside of Stockton is not extensively urbanized; about 93 percent of the land remains devoted to agriculture or is vacant. Three percent of the area is residential, and about 1/2 of 1 percent is devoted to commercial or light industrial uses. The remaining land, about 4 percent, is taken up by road and railroad rights-of-way. In general, it is expected that land use patterns in the study area will not radically change in the next 25-30 years. Urbanization will continue at a slow rate in areas generally easterly and northerly of those already developed, and a good number

of isolated rural residences will undoubtedly be built, especially along the Calaveras River. Also, a small amount of residential development ranging from low to urban density is expected to occur northerly and westerly of Linden, and some light industrial development may occur east of the Diverting Canal and south of the Southern Pacific Railroad. However, it is estimated that only an additional 2 percent of the study area will be developed to residential use, and an additional 1 percent to commercial and light industrial uses by the year 2000. The amount of agricultural or vacant land will, of course, decrease slightly (to about 90 percent of the total) by that time.

Agricultural losses during floods would include erosion of and deposition of debris and silt on crop and pasture lands; damage to orchards due to flooding of trees; damage to farm improvements such as irrigation systems, diversion facilities, and fences; possible loss of growing crops, livestock, and poultry; and increased cost of livestock maintenance. In the Delta tract area especially, losses would also include costs of dewatering flooded tracts, the cost of having land out of production for extended periods, and land treatment for weed infestation. Other flood losses would include damage to roadbeds and bridges; damage to railroad embankment and stream crossings; erosion of streamways; and damage to communications and utility distribution systems. Residential losses would include damage to foundations, floors, furnishings, and lawns and gardens. Commercial losses would comprise damage to structures and equipment, loss of business and inventories, and costs of cleanup and repair.

The impact of flooding is not limited to areas actually flooded. For example, floodwaters may interrupt or contaminate domestic and industrial water supply being conveyed by the Mokelumne Aqueduct or break sewer mains that an entire subdivision depends upon, thus creating inconvenience and potential hazards to health. Interruption of surface transportation or public utility services by floods may affect areas considerably removed from those actually flooded and result in personal discomfort and inconvenience, cessation of industrial and commercial activities and attendant loss of business and worker income. Emergency situations could be very difficult to deal with due to lack of communication or transportation. Meeting the costs of emergency flood relief, flood fighting, other flood emergency activities, cleanup, and the repair and restoration of public facilities damaged or destroyed by floods has an impact that far transcends the flooded areas because city, county, State, and Federal tax revenues must be used, thus reducing revenues available for other services, especially on the local level. Other results of flooding that impact outside the flooded areas may also include closed schools and inconvenience to the traveling public. Farm center communities such as Linden could suffer from loss of business activity when agricultural areas upon which the community depends are flooded and crops are lost or significantly reduced below normal levels.

Table 14 shows estimated dollar valuations of damages which were prevented by the New Hogan Project during selected historical floods.

Table 14

DAMAGES PREVENTED
BY NEW HOGAN DAM AND LAKE
IN HISTORICAL FLOODS

Flood Event	$ Value of Damages Prevented At Time of Flood
Jan-Feb 69	700,000
Dec 64-Jan 65	400,000 (b)
Apr 58	1,033,000 (a)
Dec 55-Jan 56	2,341,000 (a)
Nov-Dec 50	252,000 (a)

(a) Would have been prevented by project.
(b) Would have resulted without New Hogan Dam, but with Hogan Dam.

V - DATA COLLECTION AND COMMUNICATION NETWORKS

5-01. HYDROMETEOROLOGICAL STATIONS

Hydrometeorological information at New Hogan Lake and elsewhere within the Calaveras River basin is monitored through the Hydrologic Automatic Data Acquisition (HADA) system. The New Hogan Lake project office subcentral station automatically receives precipitation reports from 3 gages, Perry Ranch, Railroad Flat and Sheep Ranch, by radio. It also automatically receives project release data and reservoir stages. Temperature, wind, evaporation and precipitation data at the project must be entered into the subcentral station memory manually with thumb wheels. Data in the New Hogan Lake subcentral station memory can be interrogated by the central station (HADA central) in the Sacramento District Reservoir Control Section office. Normally, the precipitation gages automatically report every hour.

The facilities at the project include the following:

a. A gas bubbler-operated servo-manometer digital recording pool gage in the dam capable of recording pool levels up to the spillway design pool level, supplemented by a permanent staff gage in the reservoir.

b. A float-operated digital recording outflow stream gage with selsyn operated data transmission just below the dam, supplemented with visual staff gage.

c. Recording streamflow station on Calaveras River at Bellota with visual staff gage.

d. A weather station at the dam.

The weather station consists of:

a. Recording and non-recording precipitation gages.

b. A wind station recording both direction and velocity.

c. A weather bureau Class-A evaporation pan-with anemometer.

d. A recording hygrothermograph with maximum and minimum thermometers.

In addition to the project gages, the California Department of Water Resources operates a recording, radio-reporting, on-call gage on Mormon Slough at Bellota. The gage is monitored directly by the State flood operations unit in Sacramento, and the information is available to the Corps of Engineers via telephone and computerized teletype.

Hydrologic and meteorologic data are recorded and published for many sites throughout the Calaveras River basin and adjacent basins as shown on Plates 10 and 12.

5-02. WATER QUALITY STATIONS

Inflow and outflow temperatures are continuously recorded at Corps of Engineers stations and are published by the U.S. Geological Survey.

The Corps of Engineers makes extended water quality measurements on the lake and inflow and outflow at least semi-annually. Parameters measured include:

a. Temperatures, dissolved oxygen, electroconductivity, ph, suspended solids, general chemicals, and nutrients at all sites.

b. Profiles of temperature, dissolved oxygen, electroconductivity, and pH; light transparency (Secci disk); algae enumerations; and pesticides and heavy metals in New Hogan Lake.

c. Pesticide, heavy metals, and biochemical oxygen demand in the inflow.

d. Continuous temperature measurements on the inflow and outflow.

The continuous temperature data have been published by the U.S. Geological Survey in Water Resources Data for California beginning with water year 1971. The remainder of the data are reprinted in the Sacramento District's annual water quality reports.

5-03. SEDIMENT STATIONS

Sedimentation ranges have been established for New Hogan Lake, as shown on Plate 16, but no sedimentation survey program has been implemented since available data indicated that sedimentation would not be significant.

Special Report No. 10, "Reservoir Sedimentation in the Sacramento-San Joaquin Drainage Basins, California," prepared by the U.S. Department of Agriculture and dated July, 1947, estimated that average annual sediment deposition in New Hogan would be about 60 acre-feet per year. Estimates based on sediments trapped in Hogan Reservoir from 1930-1958 were even lower. Limited data for sediment transport at U.S. Geological Survey gages on the North and South Forks of the Calaveras also indicate a lower sedimentation rate. On the other hand, differences between existing area-capacity tables developed from aerial photos taken in 1977, and the previous table developed in 1963 indicate a rate of sedimentation about an order of magnitude greater than that predicted in Special Report No. 10. However, the differences are at least partly due to the difference in mathematical methods used to develop the tables. Considering the general shallowness of soils and the nearly complete absence of upstream erosion sites, it is most likely that sedimentation rates into New Hogan Lake are low as originally projected.

5-04. RECORDING HYDROLOGIC DATA

Continuous records computed of storage, computed inflow, outflow and evaporation at New Hogan Lake are kept by the Corps of Engineers District Office in Sacramento. Outflows and storages for the project are published by the U.S. Geological Survey from the Corps record. Continuous streamflow measurements at several locations throughout the Calaveras River watershed are

recorded and published by the U.S. Geological Survey. The California Department of Water Resources records streamflow measurements at several locations on the valley floor. These data were formerly published, but published streamflow data were discontinued in general by the State after water year 1975. Locations of important stations are shown on Plate 10.

5-05. COMMUNICATION NETWORK

Voice communication between the Sacramento Office and the project office is either by radio or telephone and the radios in both offices have backup power from batteries and standby generators.

The central station of the Hydrologic Automatic Data Acquisition system (HADA) in Sacramento can interrogate the subcentral stations of the projects by radio or telephone. The central and subcentral stations have backup power from batteries and standby generators.

The precipitation gages above the project and the stream gaging station at Bellota report to the subcentral station by radio only and the reservoir stage and outflow gage are hard wired to the HADA system. Streamflow data at Bellota is linked from the radio gage to Corps offices via telephone and teletype connections with the California Department of Water Resources Flood Operations Center in Sacramento.

5-06. COMMUNICATION WITH PROJECT

Oral communications between the project and the Sacramento offices of the Corps of Engineers is accomplished by radio or telephone.

Radio-reporting project gages are linked to the project office. These gages automatically report at regular intervals, and may be interrogated at anytime. Communication can also be accomplished from the District to the project through the District's computerized data system with teletype terminals. Routine, non-urgent communications may be transmitted by mail.

5-07. PROJECT REPORTING INSTRUCTIONS

The project office routinely reports basic operation data to the Reservoir Control Section in Sacramento between 7:45 and 9:00 a.m. each working day. Data include:

a. Reservoir stage and storage as of midnight.
b. Gate settings for the previous 24 hours.
c. Mean daily inflow and outflow (midnight to midnight).
d. Flow of Mormon Slough at Bellota.
e. Weather data at the dam station.
f. Reports from radio-reporting precipitation gages.

Under routine conditions, weekend and holiday reports are made on the first working day following the no-report period.

During flood operations, reports are made orally as required at the discretion of the Reservoir Control Section. Radio-reporting gages may be interrograted as necessary.

Project personnel shall contact the Reservoir Control Section immediately whenever any of the following conditions occur:

a. One-inch or more of rainfall at the project during any 6-hour period or 1.5 inches or more of rainfall during any 24-hour period.

b. Increase in flow at Mormon Slough at Bellota of 500 cubic feet per second during any 6-hour period.

c. Any significant increase in inflow to the channel below New Hogan Dam while flood control releases are being made at New Hogan Dam.

Important phone numbers and key operating personnel are shown on page iii.

5-08. WARNINGS

The Corps of Engineers, Sacramento District maintains contact with the local district office National Weather Service (NWS) at all times concerning general meteorological conditions. Some weather sequences are reported daily and others are reported on six-hour or hourly periods. General forecasts are made four times a day regularly and all pertinent information is made available to Corps offices. Quantative rainfall forecasts are issued by the NWS office in Sacramento for the Calaveras River basin. The Joint Federal-State River Forecast Center, which monitors weather conditions and river stages on a year-around basis, routinely provides river and flood forecasts that apply to lower Calaveras and San Joaquin Rivers. If floods on major streams become imminent, the Federal-State Flood Operations Center is activated. This center operates on a 24-hour basis and, among other flood emergency activities, advises all interested parties of flood situations as they develop. The center furnishes flood warnings and forecasts or river stages including the lower Calaveras and San Joaquin Rivers to the local news media, law enforcement agencies, and other responsible agencies for their use and for dissemination to the public. When rates of releases are expected to increase in excess of 1,000 cfs in 6 hours, the sheriff of San Joaquin County, the Stockton East Water District, the State Department of Water Resources, the State-Federal River Forecast Center, and the State Flood Operations Center will be notified by the Corps District Office, Reservoir Control Section. Local television and radio stations and newspapers will be notified in order that they may warn the general public. The Park Manager at New Hogan will warn the general public in the vicinity of the dam by telephone.

There are no specific formalized plans for flood fighting or emergency evacuation of people and personal property from Calaveras River flood plain. However, San Joaquin County has a standing emergency plan that covers floods as one of several possible emergency situations. The plan provides for an emergency services council and a variety of actions for pre-emergency, actual emergency, and post-emergency situations. The California Department of Water Resources, through the Flood Operations Center, coordinates flood fighting activities throughout the State and is authorized to receive requests from local public agencies for assistance during floods. The Corps of Engineers responds to requests for flood fighting and rescue work from the California Office of Emergency Services (OES) when the emergency is beyond the capabilities of State and local governmental agencies.

Pursuant to the provisions of Section 8589.5, Government Code of California, emergency procedures must be established for the evacuation and control of areas of potential flooding in the event of sudden failure of dams. The Corps of Engineers has complied by preparing a map showing areas that would be inundated by failure of New Hogan Dam. On the basis of the map, the OES in cooperation with the California Department of Water Resources will designate evacuation areas. The local jurisdiction must then adopt emergency procedures that include, among other things, specific routes to be used for evacuation; traffic control measures, movement of people without their own transportation; shelter of evacuees; evacuation and care of people from institutions; and perimeter security, interior security, and reoccupation of evacuation areas.

VI - HYDROLOGIC FORECASTS

6-01. GENERAL

The purpose of the forecasting system for the New Hogan Project is to estimate anticipated inflows to New Hogan Lake and local channel flows below New Hogan Dam so that outflow rates may be adjusted to achieve the highest degree of control of non-damaging downstream flows, and damaging flows may be foreseen in order to give the earliest possible warnings. (Please see section 5-08 for a description of the flood warning system.)

6-02. FLOOD CONDITION FORECASTS

Forecasts of inflows are based on three variables: current inflows, measured precipitation, and forecasted precipitation.

Current inflows to New Hogan Lake are estimated from outflows plus the change in storage for the time period immediately preceeding the current one, taking into account an estimated rate of change of inflows. Inflows to the area below New Hogan Dam are estimated from outflows and the instantaneous flow measurements obtained by telemetry from the streamflow gage on Mormon Slough at Bellota.

Precipitation is measured by telemetry from the project hydro-meteorological stations and both the upper and lower portions of the Calaveras River basin. The gages report at hourly intervals.

Precipitation amounts are forecast for the Calaveras Basin by the National Weather Service (NWS) in Sacramento. During periods of significant anticipated precipitation, the NWS forecasts precipitation for four to twelve hour periods for the twenty-four hour period following the forecast. These short-term forecasts are updated three times daily at 6:00 a.m., at 12:00 p.m., and at 4:00 p.m.

The precipitation and streamflow data are translated into a prediction of inflows by means of a formalized procedure which accounts for precipitation losses due to evapotranspiration and infiltration; direct runoff due to excess precipitation; and base flow resulting from precipitation losses to infiltration in previous periods. Current and projected precipitation loss rates are estimated from previous measured precipitation and inflows. Base flow is estimated from previous inflow compared with previously projected inflows. Direct runoff is projected from excess precipitation by means of a unit hydrograph.

Two hour unit hydrogrpahs for the computation of inflow to New Hogan Lake and for the local area New Hogan Dam to Bellota are shown on Plate A-8. The precision, accuracy, and reliability of the inflow forecast procedure is under continual evaluation.

6-03. CONSERVATION PURPOSE FORECASTS

No reliable scheme of forecasting inflows has been developed for more than a few hours in the future. Expected inflows can only be estimated in

terms of statistics of historic inflows. On the other hand, fairly reliable forecasts of water demand can be made although demand, too, is partly dependent on basically unpredictable meteorological variables.

6-04. LONG-RANGE FORECASTS

No reliable scheme of long-range forecasting has yet been developed. Consequently, no long-range forecasts are made.

VII - WATER CONTROL PLAN

7-01. GENERAL OBJECTIVES

The New Hogan Project is a multi-purpose development with the objectives of protecting areas below New Hogan Dam with a high degree of protection from floods; providing a conservation yield for irrigation and a municipal and industrial supply including an annual firm yield; and maintaining an inactive pool of 15,000 acre-feet when water is available.

7-02. MAJOR CONSTRAINTS

The maximum non-damaging flow of the Calaveras River from New Hogan Dam to the San Joaquin River is 12,500 cfs, although some erosion and bank sloughing occurs at flows well below the maximum non-damaging flow. Sloughing is more likely to occur when channel flows decrease rapidly; therefore, rates of changes in releases from New Hogan Lake are limited.

Maximum storage normally available for flood control at New Hogan is 165,000 acre-feet.

7-03. OVERALL PLAN FOR WATER CONTROL

The specific objectives of the operation of the New Hogan project are:

a. Restrict flows on Mormon Slough at Bellota to the non-damaging channel capacity of 12,500 cfs as much as possible.

b. Provide the maximum practical amount of conservation storage without impairment of other project functions.

c. Maintain an inactive pool of 15,000 acre-feet when water is available for this purpose.

d. In the event of extremely rare rain floods, where safety of the dam is threatened, assure structural integrity and operational control without worsening downstream conditions by operating the gated spillway in accordance with a pre-determined procedure.

7-04. STANDING INSTRUCTIONS TO DAMTENDER

During normal flood periods, the outlet works and spillway gates will be operated in accordance with normal regulations for flood control cited in paragraph 7-05 and in Exhibit A of this manual. Exhibit A is designed to function as a separate, complete document for sole use as a guide for flood control operation. Charts required for normal and emergency flood control operation are provided therein.

Instructions for storage and release of floodwaters in the flood control space will be issued by personnel of the Reservoir Control Section, Sacramento District, Corps of Engineers. In the event communications with the Sacramento District offices are disrupted, the outlet works and spillway gates shall be operated in accordance with the emergency regulation for flood control operation in paragraph 7-05b.

7-05. FLOOD CONTROL

Flood control operation begins when storage in New Hogan Lake exceeds the flood control space required on the particular day as determined from the Flood Control Diagram, Chart A-10. The flood control diagram is the basic project document regarding operation for flood control. This diagram is the result of a careful analysis of flood frequency, seasonal flood potential, and downstream channel capacities consistent with project objectives and operation experience gained during the last 16 years. The diagram requires:

a. 165,000 acre-feet of flood control storage reservation from 30 November through 31 December.

b. As much as 165,000 acre-feet of flood control storage reservation from 1 January through 20 March, depending on a precipitation index of basin wetness.

c. Uniformly increasing flood control storage reservation from none on 30 September to 165,000 acre-feet on 30 November.

d. Uniformly decreasing flood control storage reservation from 165,000 acre-feet on 31 December decreasing to none as early as 8 May and as late as 9 June, depending on a precipitation index of basin loss rates.

The precipitation index is computed from daily mean basin precipitation weighted according to station normal annual precipitation at the four project hydrometeorological system gages. Unit weightings are indicated on the Flood Control Diagram. The index is computed by summing previous daily mean basin precipitation values decayed by four percent per day to the current date.

Flood control releases under different conditions of pool elevation and inflow are indicated on the release schedule on the Flood Control Diagram.

Releases during normal flood control operations shall not be changed more than 2,000 cubic feet per second in any 2-hour period.

During very large floods that may cause the level in New Hogan Lake to rise above gross pool level with consequent loss of control, operation of the gated spillway shall be in accordance with the Emergency Spillway Release Diagram shown on Chart A-9. Whenever the reservoir level approaches gross pool level and is rising rapidly because of flood inflow, the necessity for initiating emergency releases should be checked on this diagram at frequent intervals. When the diagram indicates that emergency releases should be initiated, it is essential that these releases should be made immediately and that subsequent changes in release be made as soon as indicated. This diagram was based on a study of the <u>minimum</u> releases that could be made during very large floods without endangering the structure, without causing peak outflows that exceeded the peak natural flow at the damsite, and without requiring excessively rapid changes in release. The diagram is designed to defer emergency releases until it is virtually certain that those or larger releases will be necessary. Consequently, any deferment of releases will result in the necessity of making still larger subsequent releases. For this reason, the Damtender must be thoroughly familiar with the Emergency Spillway Release Diagram.

7-06. RECREATION

The recreation feature at the New Hogan project generally requires no specific control of releases for recreation purposes. However, water stored in the inactive pool for recreational purposes cannot be released without the approval of the Sacramento District Engineer.

7-07. WATER QUALITY

With the exception of occasionally low dissolved oxygen in the New Hogan Lake's epilimnion during summer and fall, water quality in the Calaveras River basin is generally excellent, and no specific project operation is required to enhance water quality.

7-08. FISH AND WILDLIFE

The New Hogan Project is not operated specifically for fish and wildlife purposes, although the lake supports a significant diverse fish population, and bird and mammal populations as well.

At the request of the California Striped Bass Association, Congressman McFall obtained a house resolution authorizing the Sacramento District, Corps of Engineers to investigate the feasibility of providing releases from New Hogan Lake for enhancing a downstream King Salmon fishery, considering both specific releases for fishery purposes and dual use of irrigation releases. The study concluded that these releases, including dual use of irrigation water, would not be feasible.

7-09. WATER SUPPLY

The principal service area for the New Hogan Project is within the area served by the Stockton East Water District, and the water utilized within that district is in accordance with the rights and entitlements administered by that utility.

The Bureau of Reclamation administers the sale of project water for conservation purposes. A contract dated 25 August 1970, covering repayment of the conservation service rendered by the project, was executed between the Stockton East Water District, Calaveras County Water District and the U.S. Government. In another contract between the two Districts, also executed on August 25, 1970, the safe yield of the reservoir was established as 84,100 acre-feet, with approximately a 25 percent deficiency factor for dry years. This contract also defines the area of water use for New Hogan in Calaveras County, while the Stockton East Water District consideres its area of use to be that area within the boundary borders of the District. The Stockton East Water District presently supplies about 20,000 acre-feet annually for municipal and industrial water supply in and near the City of Stockton, and about 30,000 acre-feet annually for irrigation in the lower Calaveras River basin. These amounts are considered close to the system's limits.

Operation for irrigation shall be as follows:

a. All inflow in excess of water supply demands will be stored up to the maximum permitted by flood control operation requirements.

b. Releases for water supply will be in accordance with daily requirements as determined by the Stockton East Water District, unless the release is required for flood control purposes. Ordinarily, daily water supply releases are coordinated between the Stockton East Water District and the New Hogan Park manager.

c. Water stored in the inactive pool for recreational purposes shall not be released without the advance approval of the District Engineer of the Sacramento District, Corps of Engineers.

7-10. HYDROELECTRIC POWER

There are now no facilities for hydroelectric power generation at the New Hogan Project or anywhere else in the basin.

The Calaveras County Water District is studying the feasibility of adding a hydroelectric powerplant at New Hogan Dam. The plant would generate power only on releases for other project purposes, and the present operational objectives, and procedures would not be altered.

7-11. NAVIGATION

Navigation is not a project purpose, and there have been no navigation projects on the Calaveras River.

7-12. OTHER

a. Drought Contingency Plan. During droughts, flood control is not expected to be a principle factor in the operation of New Hogan Lake. Conservation water and conservation space is managed by local interests in accordance with existing contracts. During droughts the Calaveras River Watermaster and the various groups he represents can be expected to conserve water to the best of their ability. Any information that the Corps of Engineers may have that would be beneficial to drought operation will be passed on to Calaveras River Watermaster. In extreme cases it may be desirable to pump water from the sediment pool below the outlet invert. It should be noted that project toilets and shower and sink fixtures are low flow or microflow types.

b. There is no significant regulation of flows upstream of New Hogan Lake. Irrigation development is confined to a few relatively small areas supplied by surface diversions.

7-13. DEVIATION FROM NORMAL OPERATION

Occasional deviations from normal operation are expected. Any deviations from normal flood control procedures must be approved in advance by the District Engineer, Sacramento District, Corps of Engineers. Emergency and some minor deviations can be made at the discretion of the Park Manager as discussed below.

a. Emergencies. Some deviations that can arise from emergency conditions, include: downstream drownings or other accidents; equipment or livestock in downstream channels; and failure of important operational facilities. Actions taken during emergencies can worsen the impact of

concurrent conditions. The District Engineer will be informed as soon as possible of any emergency deviations.

b. Unplanned Minor Deviations. Unplanned instances not considered emergencies can also create needs for temporary minor deviations from the normal regulation of the reservoir. Construction activities usually account for the greatest part of these minor deviations. Typical construction activities include: utility stream crossings, bridge work, bank protection work, and major construction projects. Changes in releases are sometimes necessary for maintenance and inspection. Requests for changes of release rates are generally given for a few hours to a few days. Each request is analyzed on its own circumstances. Consideration is given to upstream watershed conditions, flood potential, reservoir conditions, and possible alternative measures. In the interest of maintaining good public relations, the requests are complied with, providing there are no adverse effects on the overall operation of the project for the authorized purposes. The District Engineer will be informed, in advance, if possible, of all minor deviations proposed or anticipated.

c. Planned Deviations. Long-term deviations shall be analyzed on their particular circumstances and merits. Flood potential, reservoir and watershed conditions, alternative measures, expected benefits and probable effects on other projects are particularly important; these should be presented with requests for long-term deviations. Requests and pertinent data will be made by telephone or letter to the District Engineer, Sacramento District, Corps of Engineers, as far in advance as possible.

7-14. RATE OF RELEASE CHANGE

Releases from New Hogan Lake shall not be changed more than 2,000 cubic feet per second in any 2-hour period to permit orderly evacuation of personnel, property, livestock, etc., in advance of rising water downstream and to minimize bank sloughing and caving as the flow recedes after an extended period of bankful flows.

VIII - EFFECT OF WATER CONTROL PLAN

8-01. GENERAL

The New Hogan Project regulates floodflows in the lower Calaveras River basin by controlling its releases to obtain the maximum practical reduction in flood damages. The flood control storage in New Hogan Lake is sufficient to control all floods of record as well as all other floods with more than 0.4 of a percent annual chance of occurrence. At Bellota, control of flows due to New Hogan is sufficient to control all floods of record and all other floods with more than a 1 percent chance of annual occurrence to the channel capacity of 12,500 cubic feet per second.

Water supply (or conservation) storage in New Hogan Lake will provide about 84,000 acre-feet of water with a 25 percent deficiency in the historical drought years.

New Hogan Lake creates local environment attractive to many species of birds and terrestrial wildlife as well as a habitat for large, diverse fish populations. The lake also provides recreation opportunities for an estimated current annual average of about 257,000 visits.

8-02. SPILLWAY DESIGN FLOOD

Design of the spillway development of the Emergency Spillway Release diagram, and establishment of the dam crest and real estate acquisition lines were based on hypothetical routings of the Spillway Design Flood (SDF). This flood was presented in Design Memorandum No. 1, Hogan Project, Calaveras River, California, dated 15 January 1957, and was based on an analysis of maximum possible precipitation by the Hydrometeorological Section of the former Weather Bureau, contained in a letter dated 13 July 1956. (Soon thereafter, precipitation amounts were revised; however, a review of other basin parameters, such as loss rates and unit-hydrographs indicated that the revised precipitation amounts did not result in runoff materially different from that in Design Memorandum No. 1. Therefore, the original Spillway Design Flood was retained.)

A flood similar to the Spillway Design Flood would result from a combination of the most severe meteorologic and hydrologic conditions considered possible in the basin above the dam. The most critical sequence of storms over the Calaveras River basin would result from a storm of Standard Project[1/] magnitude; then have a four to eight day period of cold, stormy weather, during which the snowpack approaches the maximum of record over the basin; and then followed by the probable maximum storm. Pertinent hydrologic parameters for the probable maximum event were:

Storm Rainfall	16.80 inches
Snowmelt	4.06 inches
Total	20.86 inches
Loss	3.36 inches
Excess (Runoff)	17.50 inches
Peak Inflow	132,000 cubic feet per second
Inflow Volume	350,000 acre-feet
Freeboard	5 feet

1/ See Section 8-03.

A hypothetical routing of the Spillway Design Flood through New Hogan Lake in accordance with the Emergency Spillway Release Diagram (Chart A-9) resulted in a maximum pool elevation of 720 feet, with total maximum storage of 356,000 acre-feet according to original area-capacity- elevation curves, including 25,000 acre-feet of surcharge storage (storage above gross pool). The outlet works were assumed closed. The maximum outflow was 118,000 cubic feet per second. Plate 17 presents hydrographs pertinent to the routing.

A revised Probable Maximum Flood was developed in 1978 for a periodic spillway adquency study. The probable maximum precipitation used was 23.7 inches, however snowmelt was not considered since it was assumed that the antecedent conditions would melt any snow cover on the Calaveras River basin. The peak of the resulting inflow was 162,500 cubic feet per second, and the volume was 380,000 acre-feet. Hypothetical routings through New Hogan Lake indicate that minimum freeboard would be about 3.1 feet.

8-03. FLOOD CONTROL

The principal objective of the flood control plan is prevention of flooding in the agricultural, urban, and suburban areas adjacent to lower Calaveras River, Mormon Slough, and Stockton Diverting Canal. The flood control storage provided in New Hogan Lake is sufficient to control all floods of record and all other floods uo to a 1 percent chance of occurrence, utilizing the design channel capacity of 12,500 cubic feet per second at Bellota.

The flood control storage provided in New Hogan Lake is based on a Standard Project Flood (SPF). SPF is defined as one that can be expected from the most severe combination of meteorologic and hydrologic conditions characteristic of the region, excluding extremely rare combinations. The SPF developed for the New Hogan Project is presented in detail in Design Memorandum No. 1, Hogan Project, Calaveras River, California, Hydrology, dated 15 January 1957. Some important parameters for the SPF inflow to New Hogan Lake are:

Storm Rainfall	15.05 inches
Snowmelt	0 inches
Total	15.05 inches
Loss	4.09 inches
Excess (Runoff)	10.96 inches
Peak Inflow	66,000 cubic feet per second
Inflow Volume	212,200 acre-feet

Precipitation was distributed based on the storm of November 1950. The first 60 hours of the storm were increased by 34 percent, and the last 40 hours by 28 percent, to conform with estimates of SPF depth-duration values.

SPF's were also developed for the local area below New Hogan Dam, one concurrent with the SPF Storm centered over the upper basin, the other centered below New Hogan Dam, above Bellota. The peak flow of the latter, (12,500 cubic feet per second) was the design flow for improvements made in the late 1960's to Mormon Slough, the Stockton Diverting Canal, and the Calaveras River, all of which below Bellota. More recent investigations indicate that the SPF flows for a storm centered over the basin below New

Hogan Dam, above Bellota, would reach 22,700 cubic feet per second in Mormon Slough at Bellota.

A hypothetical routing of the SPF is presented on Plate 18, along with hypothetical routings of two large historical floods.

8-04. RECREATION

As shown in Table 15, recreation attendance at New Hogan Lake averaged 256,700 recreation days annually from 1963, when the project opened, through 1981.

TABLE 15

NEW HOGAN LAKE - ESTIMATED ANNUAL VISITATION 1963 - 1981

Year	Attendance in Recreation Days
1963	39,600
1964	103,400
1965	248,800
1966	344,200
1967	300,500
1968	343,200
1969	294,200
1970	254,900
1971	321,100
1972	259,400
1973	233,600
1974	241,100
1975	274,200
1976	194,200
1977	117,000
1978	248,100
1979	286,000
1980	335,200
1981	439,300
Total 1963 - 1981	4,878,000
Average 1963 - 1981	256,700

Based on combined data from Corps of Engineers recreation use surveys conducted from 1964 through 1969, an average of 67 percent of the visitors attend the lake on weekends. The peak weekend is traditionally Memorial Day with a visitation of about 14,000 recreation-days. Other holidays such as the Fourth of July and Labor Day also have high attendance. Based on recreation use surveys conducted during the years 1965-1975, visitation for the 5-month recreation season, April-August, averages about 188,648 recreation-days.

8-05. WATER QUALITY

The water control plan has had minimal adverse impacts on Calaveras River and New Hogan Lake water supply. Water quality throughout the Calaveras River basin may be generally characterized as excellent for all beneficial uses.

8-06. FISH AND WILDLIFE

The impoundment of Calaveras River water behind New Hogan Dam has provided a habitat and attraction for expanded diverse freshwater and terrestrial communities, as discussed partly in Section 7-08.

8-07. WATER SUPPLY

Under natural conditions, a large portion of annual runoff can occur during one or more relatively short flood events. In addition the need for water exists during late spring in the summer, while nearly all annual runoff occurs from late fall through early spring. Moreover, annual natural runoff is highly variable, and relatively dry periods, when annual runoff is less than annual demand, can occur over periods of several years. New Hogan Lake essentially stores winter runoff for use during summers and dry years. Up to 317,100 acre-feet may be carried over into summer, while up to 152,100 acre-feet may be carried over from one year to the next. Studies performed during planning stages indicated New Hogan Lake would make about 70,000 acre-feet of new and reregulated water available per year. For the water years 1965 through 1980, about 48,000 acre-feet of new and reregulated water were made available annually. This period includes two years of severe drought (1976-1977), during which New Hogan supplied about 119,000 acre-feet of new and reregulated water.

8-08. HYDROELECTRIC POWER

None.

8-09. NAVIGATION

None.

8-10. FREQUENCIES

a. Unregulated Flow Frequencies. Unregulated flows and statistical parameters for Calaveras River at New Hogan Dam for rain floods are tabulated on Plate 19. Flow frequency curves for peak, 1 day, 3 day, 7 day, 15 day, and 30 day flows for rain floods are shown on Plate 20. The statistics were computed using the HEC Regional Frequency programs.

b. Peak Flow Frequencies Project Condition. Peak flow frequency curves for the Calaveras River below New Hogan Dam and Mormon Slough at Bellota for project conditions for rain floods are shown on Plates 21 and 22, respectively. Curves reflect operation of New Hogan Dam for the period 1963-1982 which includes both dry and wet periods and is representative of a longer period of record. In order to extend the flow frequency curves to include very rare events, such as the one percent and rarer floods, hypothetical floods were routed through New Hogan Lake.

c. Stage-Frequency Curves. A stage-frequency curve is shown on Plate 23, and stage-duration curves are shown on Plate 24. The seasonal variation of reservoir storage frequency is shown on Plate 25. The level of storage is highest in the spring at the beginning of the recreation season (May-September) as a result of storing runoff for water supply and flood control. Subsequent releases made through the summer for water supply and downstream rights draw the reservoir system down for the beginning of the winter flood season.

d. Operation Record. The official record of New Hogan Lake is published in Water Supply papers of the U.S. Geological Survey.

Operation of New Hogan Dam began in December 1964 and is shown on Plate 26. A record of flood control requirements and storage and flows pertinent to flood control operation is contained in monthly reports submitted to the Chief of Engineers by the District Engineer, Sacramento District, Corps of Engineers, Sacramento, California.

e. Key Control Points. Rating curves for key control points at Calaveras River below New Hogan Dam, Mormon Slough at Bellota, and Stockton Diverting Canal are shown on Charts A-5, A-6, and A-7 respectively.

8-11. OTHER STUDIES

The Corps of Engineers neither has nor anticipates any studies in the Calaveras River basin, although it is expected that the Master Manual of Reservoir Regulation for the San Joaquin River, dated 1 July 1954, will be revised and updated. A plan for coordinating flood control operation of all facilities in the basin, including storage projects on tributary streams, bypass and diversion facilities, coordinated reporting and dissemination of hydrologic and operating data, and necessary interagency operating agreements is under study and will be discussed in the master manual.

The Calaveras County Water District is studying the feasibility of installing a hydroelectric powerplant at New Hogan Dam. The plant would generate power only on releases for other project purposes; present operational objectives and procedures would not be altered.

IX - WATER CONTROL MANAGEMENT

9-01. RESPONSIBILITIES AND ORGANIZATION

The primary responsibilities for operating New Hogan Reservoir are delegated to units of the Engineering Division and Constructon-Operations Division of the Sacramento District, Corps of Engineers, as outlined below. Names, addresses, and telephone numbers of those individuals whose responsibilities and outlined in the following paragraphs are given on the personnel sheet in front of this manual.

a. The Reservoir Control Section (Engineering Division) is responsible for:

(1) Analyzing current reservoir and hydrologic data, determining the condition under which the reservoir shall be operated, and issuing appropriate operating instructions to the designated Damtender.

(2) Preparing monthly operation and other special reports relative to operation of the reservoir as requested by the Office, Chief of Engineers, and as needed for operational purposes.

(3) Advising the District Engineer whenever there has been a departure from the operating instructions, or when there is a need for making a temporary modification of these instructions.

(4) Staying informed at all times of downstream channel conditions by making periodic field inspections.

(5) Arranging with local interests for collection of flow and diversion data.

(6) Obtaining from local interests each month a summary of requested flows, and maintaining a record of instructions issued, data transmitted to other agencies, and requests received from other agencies.

(7) Keeping the Stockton East Water District, and other local interests continuously advised of the operation of the reservoir.

b. The Park Manager (under supervision of the Construction-Operations Division) is responsible for:

(1) Accomplishing the physical operation of the reservoir in accordance with instructions contained in this manual, or as issued by the Reservoir Control Section. During storms, this may require 24-hour attendance at the dam.

(2) Calculating and maintaining a continuous record of inflows, outflows, storage, preproject flows, weather data, and other data specified by the Reservoir Control Section.

(3) Reporting by radio (or telephone) to the Reservoir Control Section the data outlined in Sections 7-04 and 9-05 and Exhibit A and other data that may be requested from time to time.

(4) Reporting any unusual condition in the reservoir, or along the downstream channel, in Mormon Slough, or the Diverting Canal which might interfere with the planned operation of the reservoir.

(5) Maintaining all trash racks clear of trash in order that the outlet gates can be operated systematically and effectively. When the water level is below the crest of old Hogan Dam, removing trash from the outlets through that structure to prevent inhibiting the release capacity of New Hogan outlets.

(6) Maintaining a log of gate operation containing (a) change in position of gates, (b) date and time when such changes are made, (c) reservoir water level, and (d) the initials of the individual accomplishing the change.

(7) Immediately after the end of each month, transmitting to the Reservoir Control Section the data specified in Sections 7-04 and 9-05 and Exhibit A.

(8) Making emergency operation changes when contact with the District Office is broken and a clearly defined change occurs that warrants immediate action.

c. Operations Branch (Construction-Operations Division) is responsible for:

(1) Budgeting project operation and maintenance funds.

(2) Maintenance of project hydrometeorological stations. (This is jointly accomplished by the Hydrology Section, Engineering Division.)

The Bureau of Reclamation is responsible for marketing and administration of the sale of project water supply.

The State of California Water Resources Control Board is responsible for administration of water rights.

The Stockton East Water District is responsible for coordinating the operation of their facilities with the Corps of Engineers operation of the New Hogan Project.

The State of California Reclamation Board is responsible for the maintenance of levees and channels on Mormon Slough, the Stockton Diverting Canal, and the Lower Calaveras River through Stockton. The San Joaquin County Department of Public Works performs the actual operation and maintenance for the Reclamation Board.

9-02. INTERAGENCY COOPERATION

To insure that the operation of the New Hogan Project is effective as possible, it is essential that the Corps of Engineers be continually advised

of all conditions with potential effects on operation. This is particularly important during flood control operations, when conditions often change rapidly, and anticipated conditions have important implications for current actions.

Flood control operations require close cooperation between the Corps of Engineers, the National Weather Service, California Department of Water Resources, and local downstream interests. Communications among these agencies is often needed hourly.

Operations involving water supply normally require close cooperation between the Stockton East Water District and the Corps of Engineers.

The Corps of Engineers coordinates with the local press with information of public interest on floods and other impacts of project operation.

The National Weather Service (NWS) office in Sacramento maintains year-around surveillance of weather conditions. The NWS distributes forecasts and is directly responsible to agencies and by way of local news media to the public. The NWS maintains and publishes meteorological data pertinent to the Calaveras River basin. Forecasts made by the NWS and their integration into project operations are described in Sections 6.01 and 6.02.

The U.S. Geological Survey manages several streamflow, sediment, and water quality gages in the Calaveras basin. Data acquired from these stations are published in annual reports, and preliminary and supplementary data are available on request. Data acquired by other agencies are also published by the Geological Survey.

The California Department of Water Resources also collects data on streamflow in the Calaveras basin, and closely cooperates in flood control activities with its radio-reporting streamflow gage at Bellota.

The Federal-State River Forecast Center and the Federal-State Flood Operations Center are important inter-agency points-of-contact; they are described in Section 6-01 and 6-02.

9-03. INTERAGENCY AGREEMENTS

None.

9-04. COMMISSIONS AND COMPACTS

None.

9-05. REPORTS

Project personnel shall report the following data to the Resevoir Control Section, by radio on each workday between 7:30 and 9:00 a.m.

a. Reservoir stage and storage as of midnight.
b. Gate settings during the previous 24 hours.

c. Mean daily flows, ending at midnight, of

(1) The Calaveras River below New Hogan Dam.
(2) Total inflow to New Hogan Lake.

d. Flow of Mormon Slough at Bellota.
e. Meteorological data at the dam.
f. Reports from radio-reporting precipitation stations.

When conditions do not warrant holiday or weekend reports, the complete report for each day shall be made on the working first day following the non-reporting period. More frequent reports of the above information and reports of other Calaveras River data will be made in the same manner when requested by the Reservoir Control Section.

Immediately after the end of each month, the Park Manager shall dispatch to the Reservoir Control Section the charts for that month from the following instruments:

a. Recording precipitation gage.
b. Pool elevation recorder.
c. Remote recording gages.

The Reservoir Control Section shall prepare monthly operation and other special reports relative to operation as required by the Chief of Engineers, and other reports as required for operational purposes.

During the rain flood season of 1 October to 1 May the Park Manager or other responsible project employee shall alert the Reservoir Control Section immediately whenever one of the following conditions occur:

a. One inch or more of rainfall at the project during any 6-hour period or 1.5 inch of rainfall in any 24-hour period.
b. Increase in flow of Mormon Slough at Bellota of 500 cubic feet per second during any 6-hour period.
c. Any significant increase in inflow to the channel downstream from New Hogan Dam where flood releases are being made from New Hogan Lake.

Any special report based on any one of the foregoing criteria should include the latest available data concerning the other three items. On holidays or weekends, the appropriate personnel listed on page iii in front of this manual should be contacted at home.

N

VALLEY SPRINGS

SAN ANDREAS

NEW HOGAN LAKE

NEW HOGAN DAM

CALAVERAS RIVER

SPILLWAY

NORTH FORK CALAVERAS RIVER

SOUTH FORK CALAVERAS RIVER

Deer Peak 1921

Buena Vista Mountain 2020

1018
1095
980
920
1164
1093
941
1322
2350
815
846
859
809
1500
821
1862
2214

LEGEND

(12) State Highway (804) County Road

Original Streambed

SCALE

1 0.5 0 1

(Miles)

NEW HOGAN LAKE
CALAVERAS RIVER, CALIFORNIA

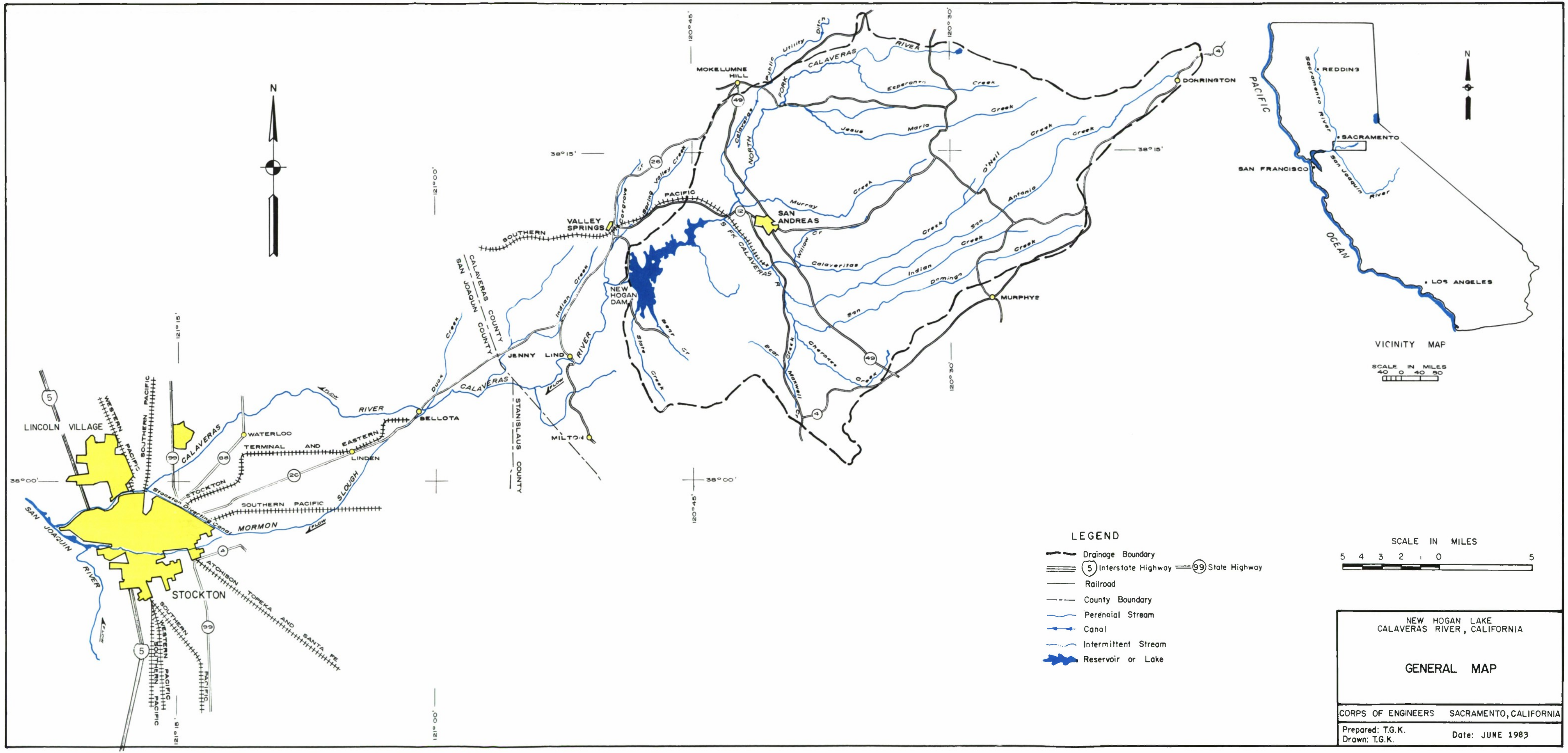
NEW HOGAN LAKE AREA MAP

CORPS OF ENGINEERS SACRAMENTO, CALIFORNIA

Prepared: T.G.K.
Drawn: C.J.H.

Date: JUNE 1983

PLATE 1



NEW HOGAN LAKE
CALAVERAS RIVER, CALIFORNIA

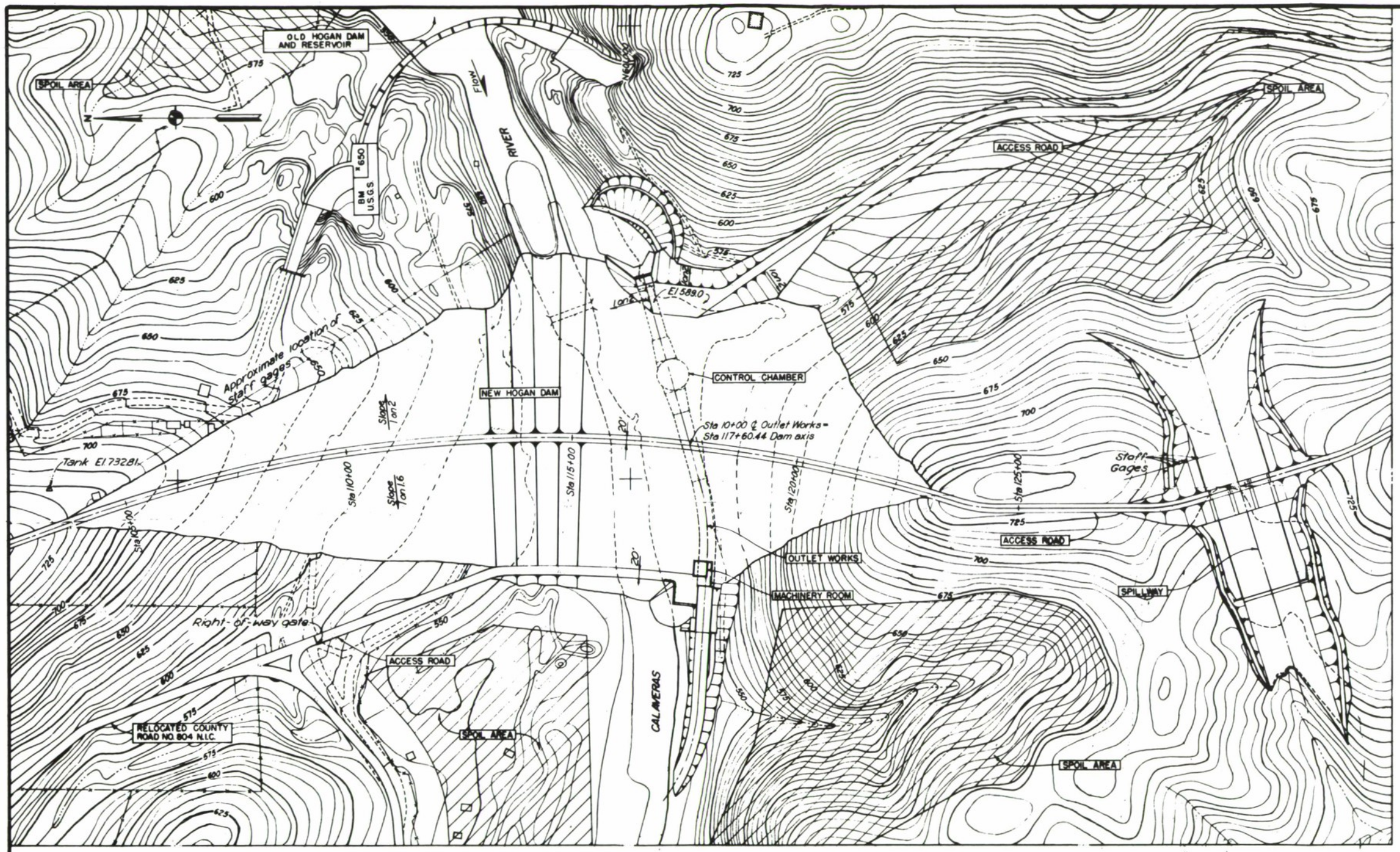
GENERAL MAP

CORPS OF ENGINEERS SACRAMENTO, CALIFORNIA

Prepared: T.G.K.
Drawn: T.G.K.

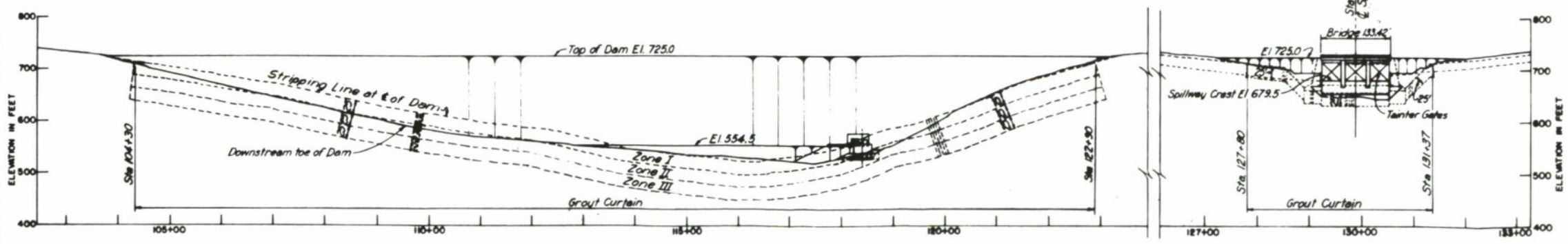
Date: JUNE 1983

PLATE 2



PLAN
SCALE: 1" = 100'-0"

GRAPHIC SCALE
1" = 100'-0" 0 100' 200' 300' 400' 500'



DEVELOPED DOWNSTREAM ELEVATION
SCALE 1" = 100'-0"

NEW HOGAN LAKE
CALAVERAS RIVER CALIFORNIA

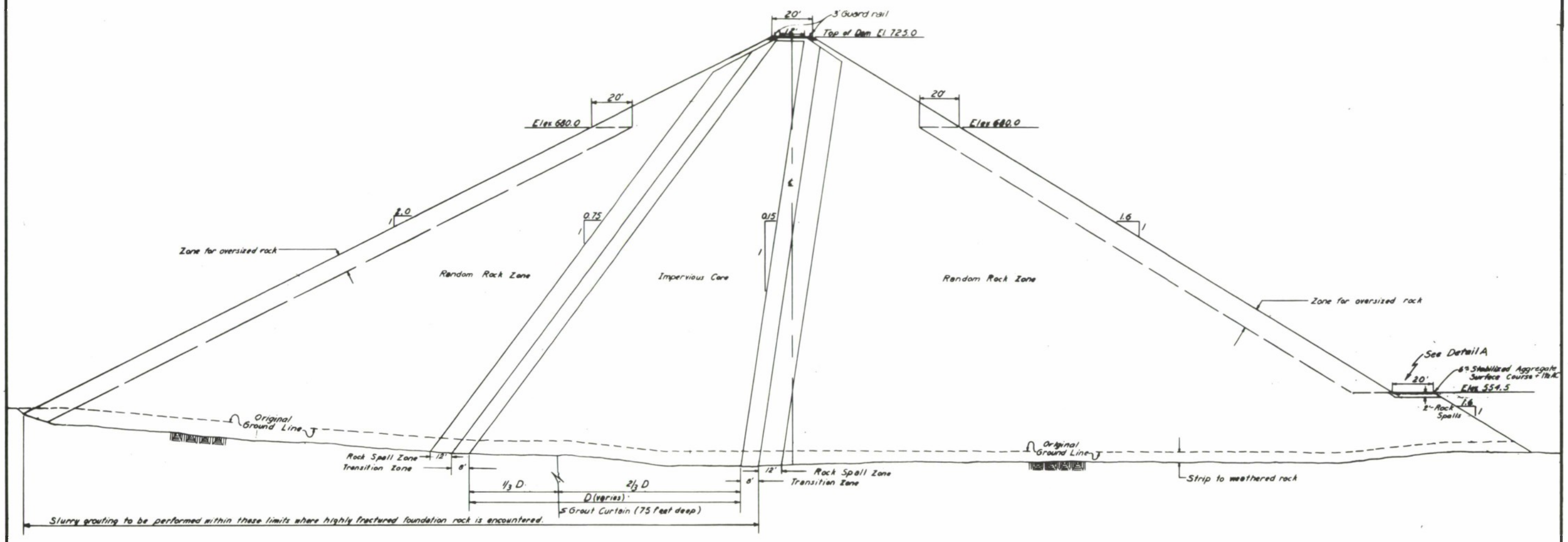
NEW HOGAN DAM

PLAN AND ELEVATION

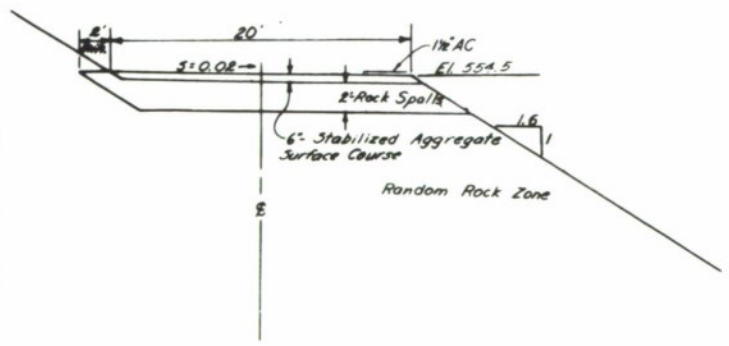
CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: T.G.K.
Drawn: R.K.J.
Date: JUNE 1983

PLATE 3

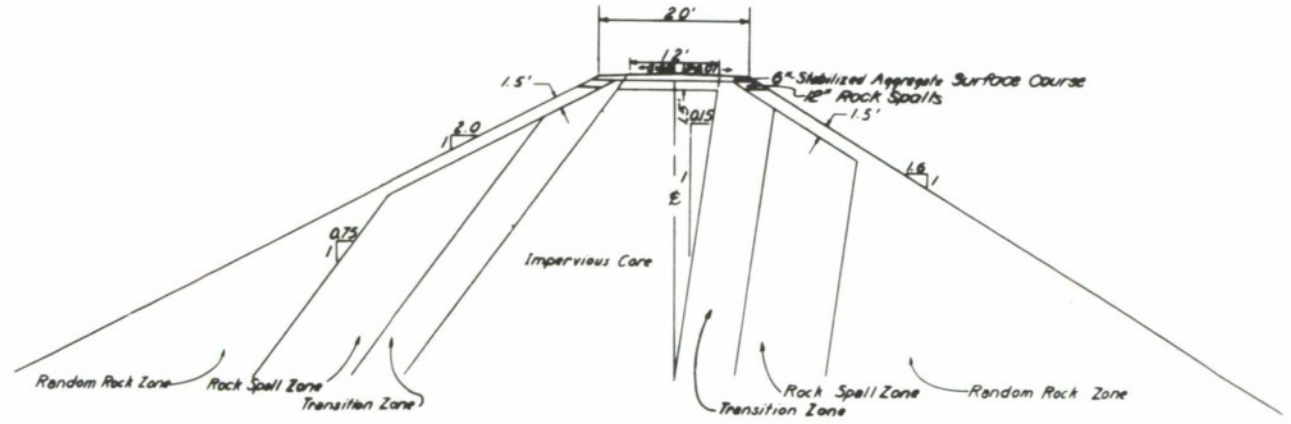


MAIN DAM
VALLEY SECTION
SCALE 1" = 20'-0"



DETAIL "A"

MACHINERY ROOM
ACCESS ROAD
SCALE 1" = 5'-0"



MAIN DAM
CROWN DETAILS
SCALE 1" = 10'-0"

GRAPHIC SCALES

NEW HOGAN LAKE
CALAVERAS RIVER, CALIFORNIA

NEW HOGAN DAM

SECTIONS

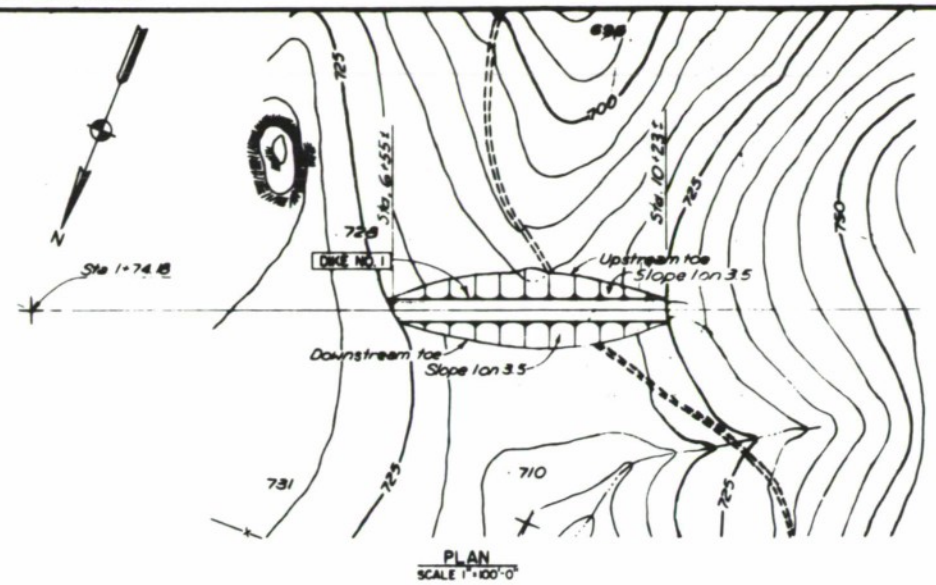
CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: T.G.K.
Drawn: E.J.E.
Date: JUNE 1983

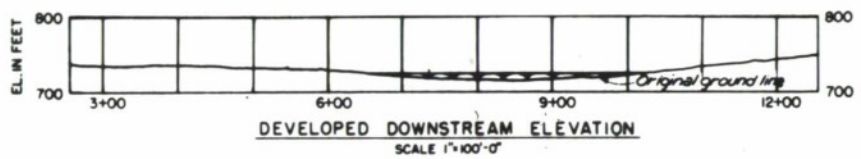
PLATE 4

CORPS OF ENGINEERS

U. S. ARMY

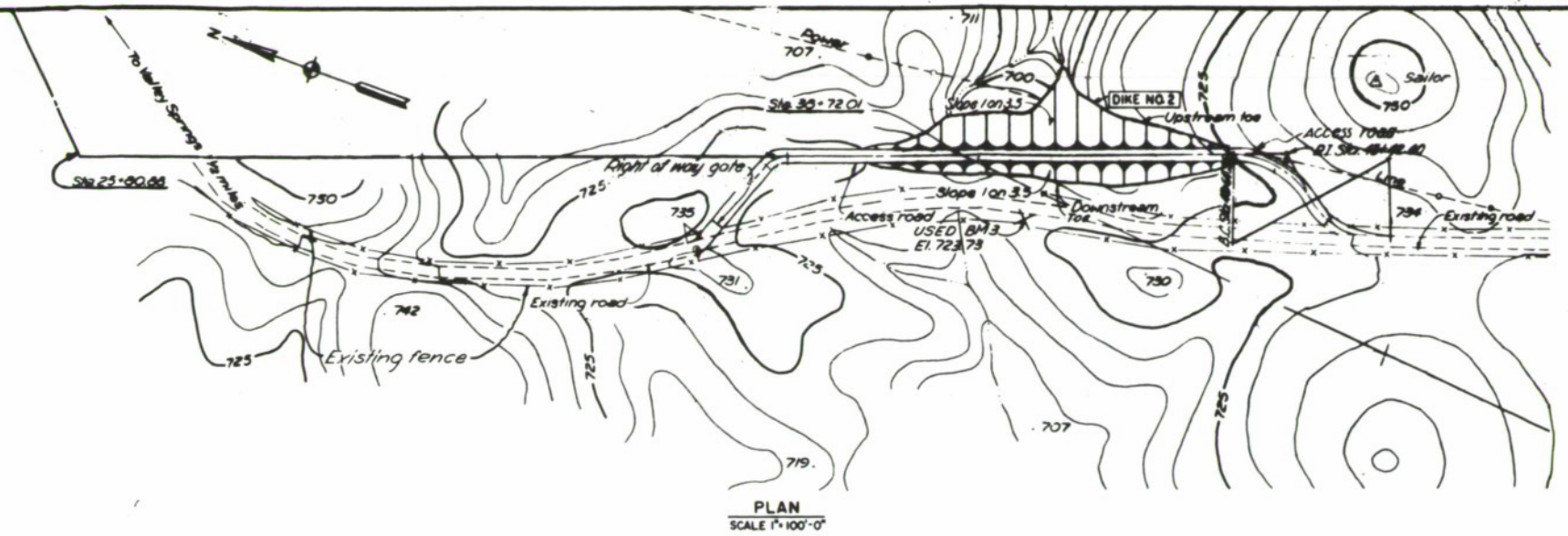


PLAN
SCALE 1"=100'-0"

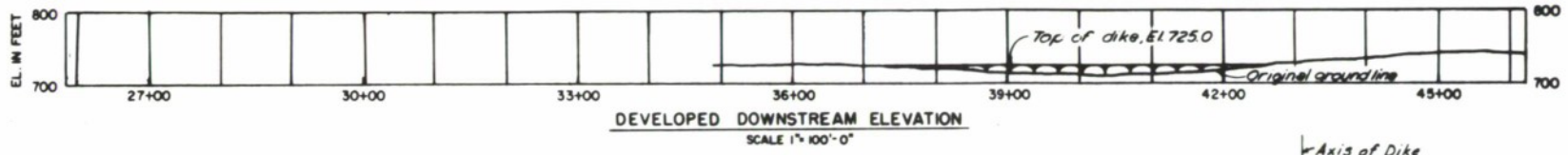


DEVELOPED DOWNSTREAM ELEVATION
SCALE 1"=100'-0"

DIKE NO. 1

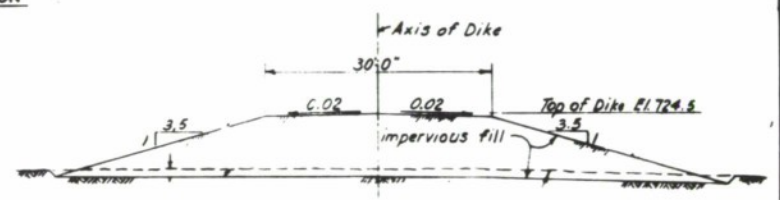


PLAN
SCALE 1"=100'-0"

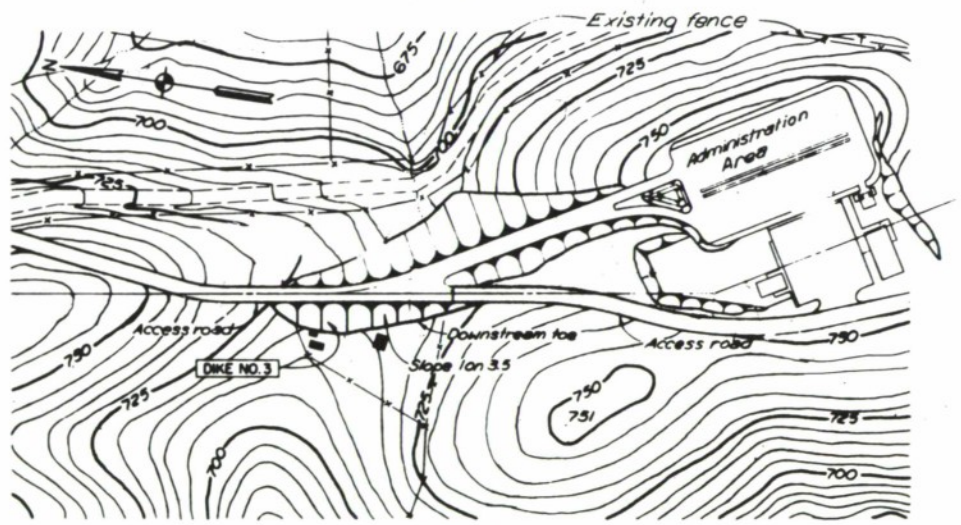


DEVELOPED DOWNSTREAM ELEVATION
SCALE 1"=100'-0"

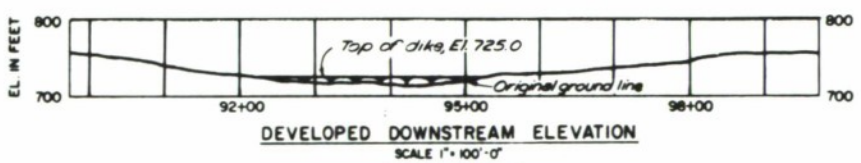
DIKE NO. 2



TYPICAL SECTION DIKE NO. 1
SCALE: 1"=10'-0"

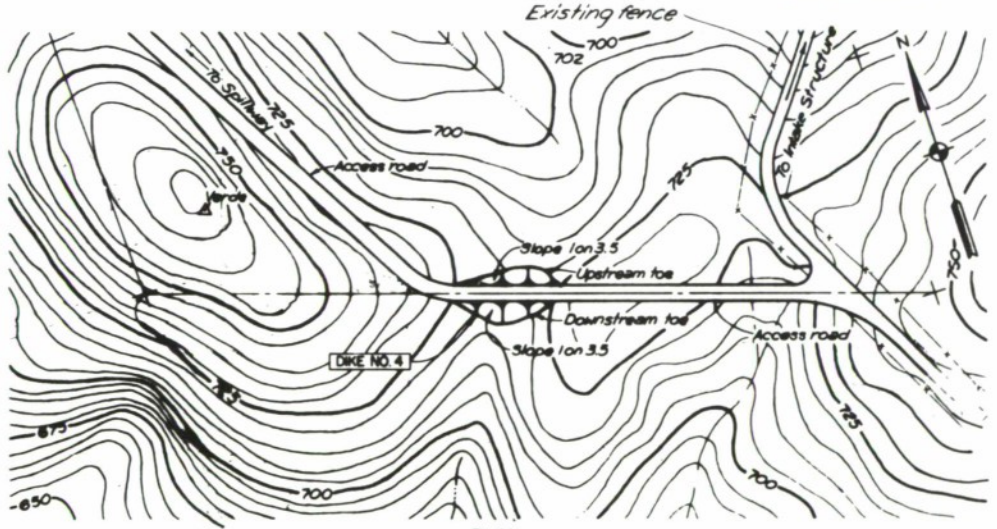


PLAN
SCALE 1"=100'-0"

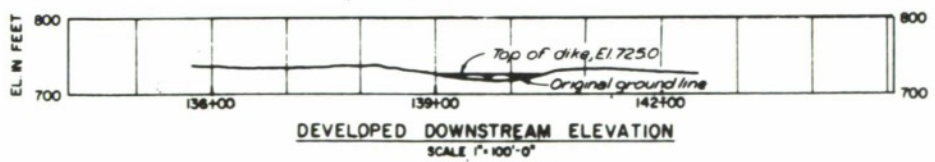


DEVELOPED DOWNSTREAM ELEVATION
SCALE 1"=100'-0"

DIKE NO. 3

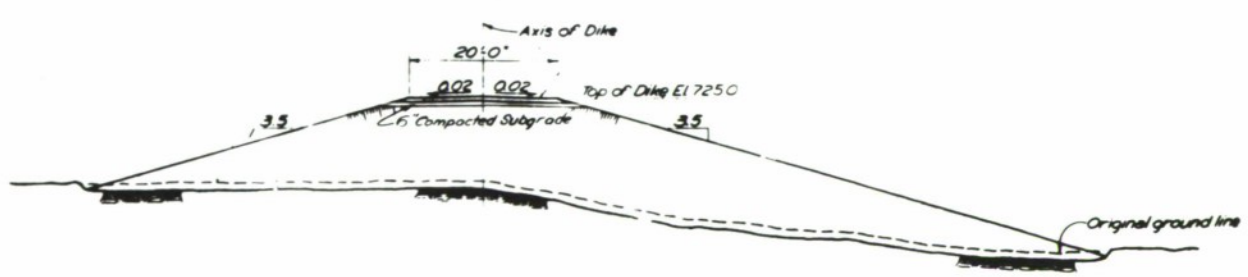


PLAN
SCALE 1"=100'-0"



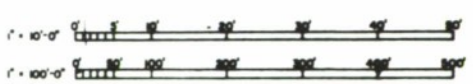
DEVELOPED DOWNSTREAM ELEVATION
SCALE 1"=100'-0"

DIKE NO. 4



TYPICAL SECTION DIKES NO 2,3 & 4
SCALE 1"=10'-0"

GRAPHIC SCALES



NEW HOGAN RESERVOIR
CALAVERAS RIVER, CALIFORNIA

NEW HOGAN DIKES

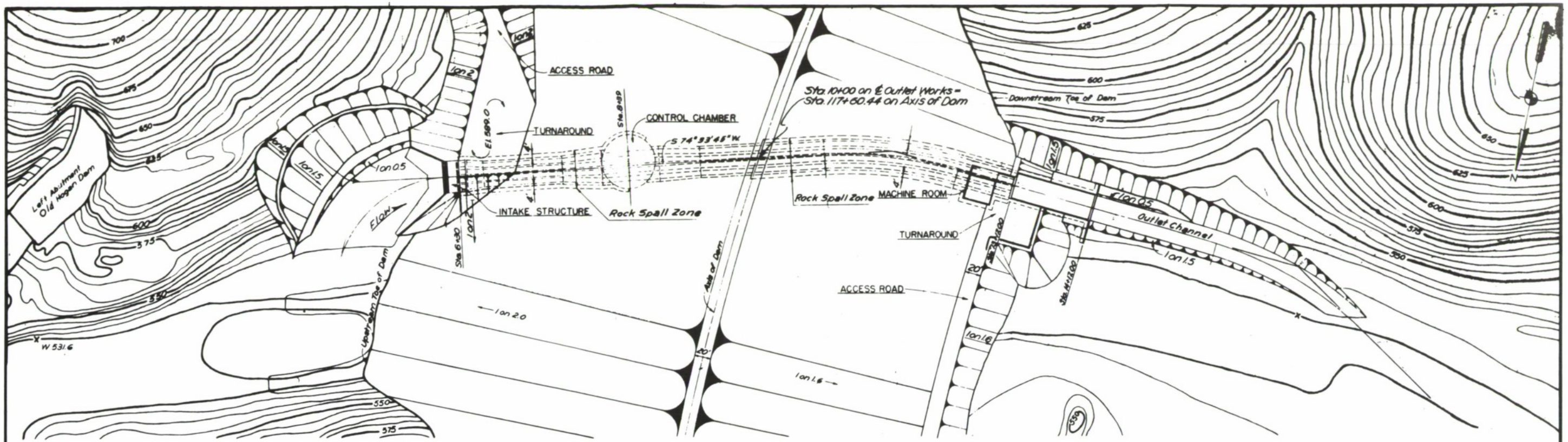
PLANS, PROFILES AND SECTIONS

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

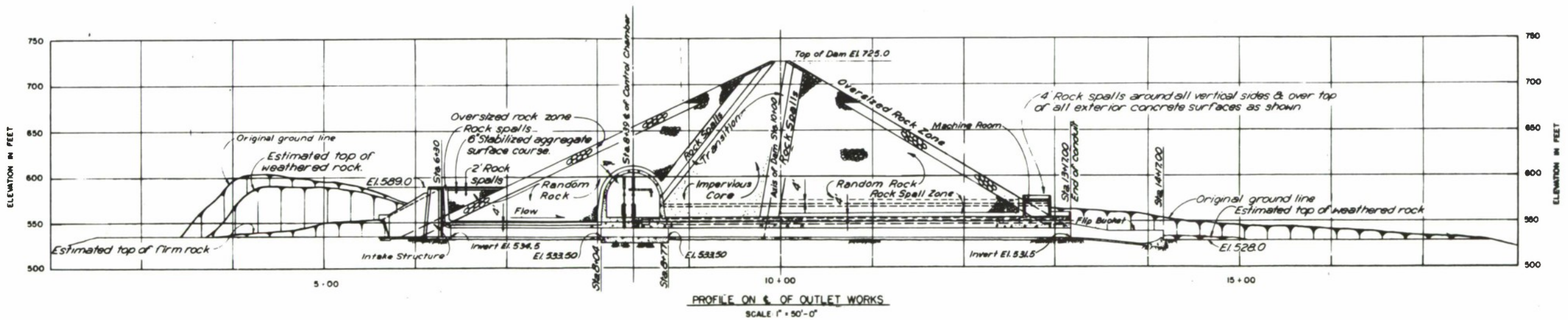
Prepared: T.G.K. Date: JUNE 1969

Drawn: C.J.M.

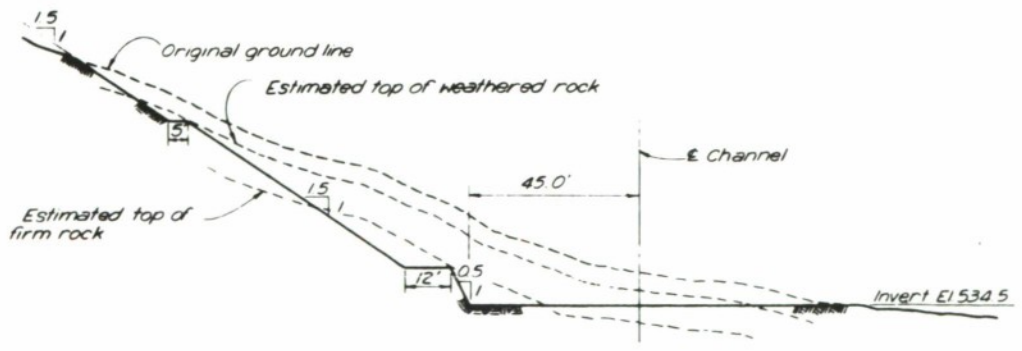
PLATE 5



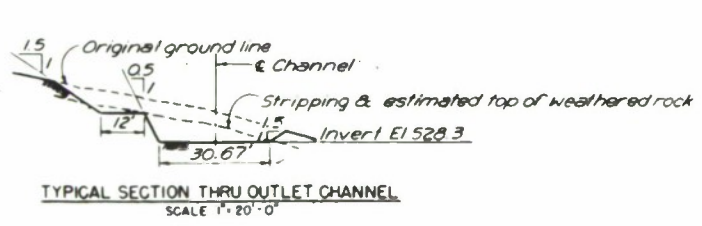
PLAN
SCALE 1" = 50'-0"



PROFILE ON ℄ OF OUTLET WORKS
SCALE 1" = 50'-0"

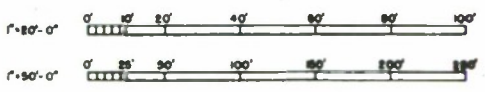


TYPICAL SECTION THRU INTAKE CHANNEL
SCALE 1" = 20'-0"



TYPICAL SECTION THRU OUTLET CHANNEL
SCALE 1" = 20'-0"

GRAPHIC SCALES



NEW HOGAN LAKE
CALAVERAS RIVER, CALIFORNIA

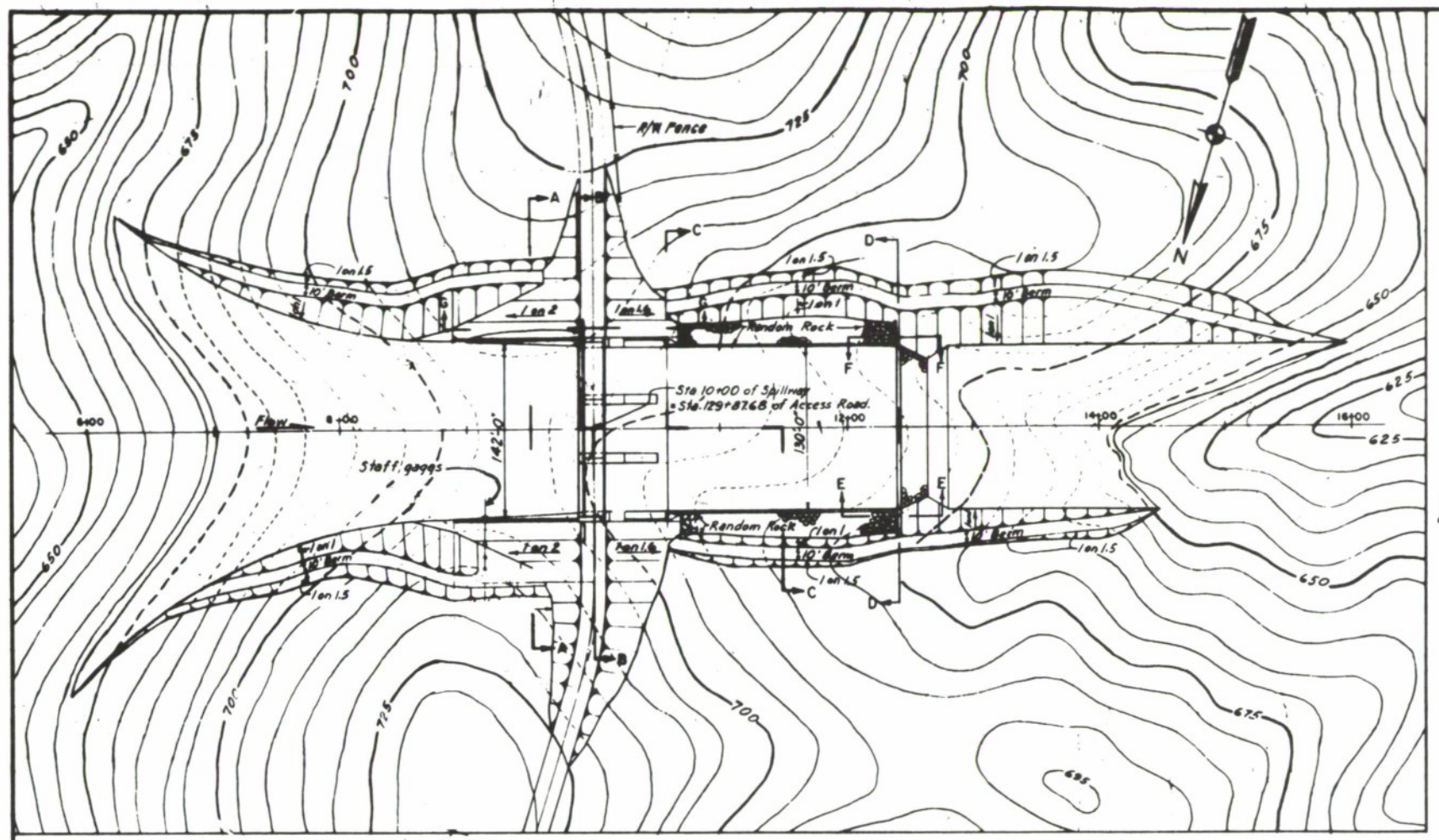
NEW HOGAN OUTLET WORKS

PLAN, PROFILE AND SECTIONS

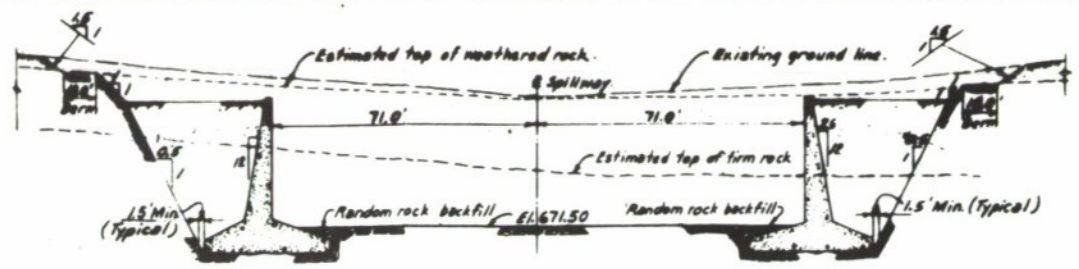
CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: T.G.K.
Drawn: D.L.S.
Date: JUNE 1983

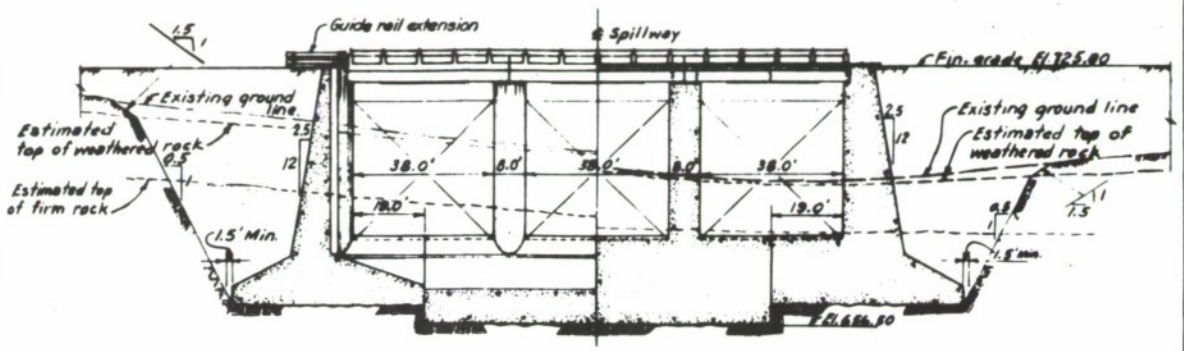
PLATE 6



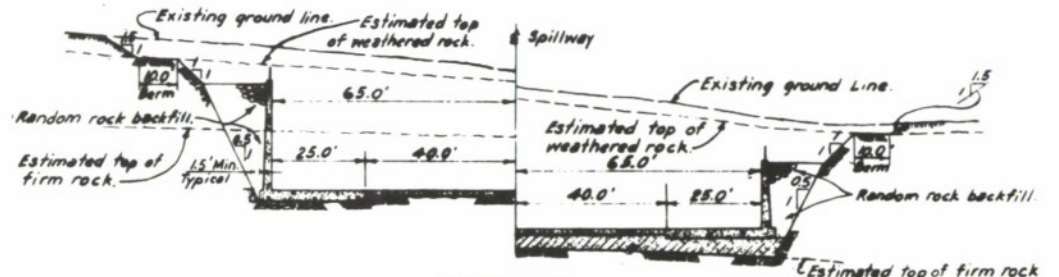
PLAN
SCALE: 1"=50'



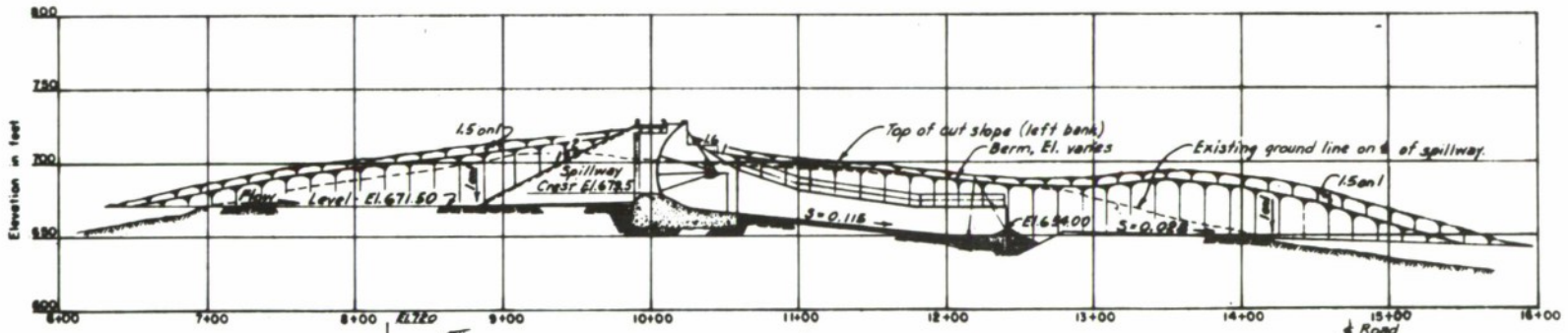
SECTION A-A
SCALE: 1"=20'



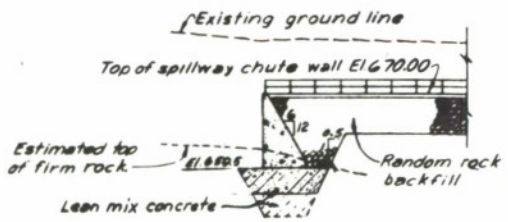
SECTION-B-B
SCALE: 1"=20'



SECTION C-C
SCALE: 1"=20'

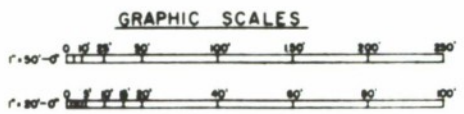


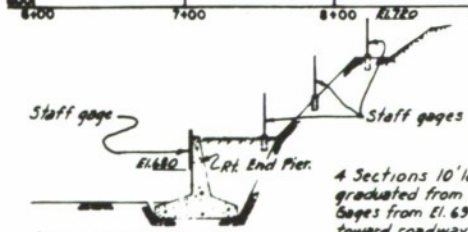
SECTIONAL ELEVATION ON ℄ OF SPILLWAY
SCALE: 1"=50'



SECTION F-F
SCALE: 1"=20'-0"

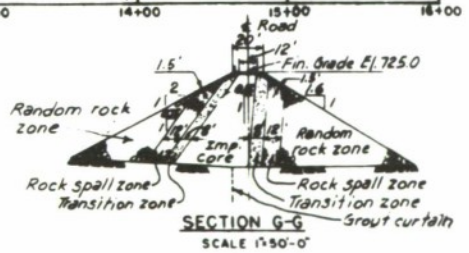
GRAPHIC SCALES



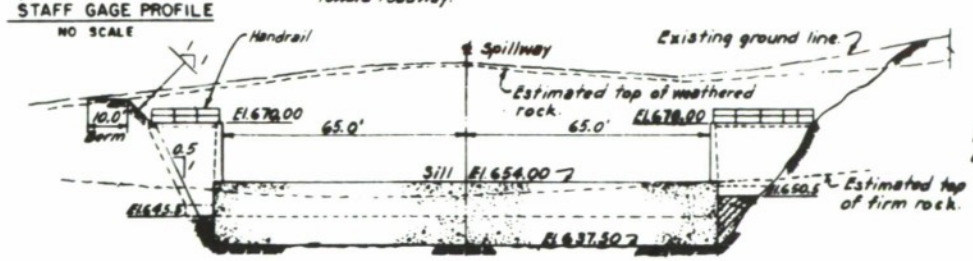


4 Sections 10' long. Bottom section graduated from El. 680.0 to 690.0 Gages from El. 690.0 to 720.0 to face toward roadway.

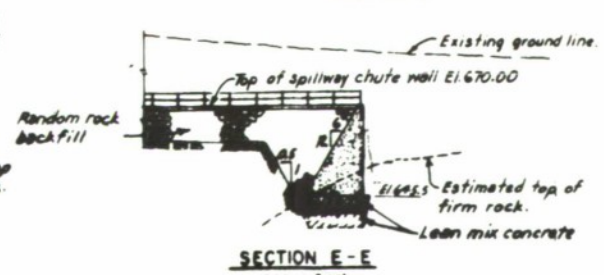
STAFF GAGE PROFILE
NO SCALE



SECTION G-G
SCALE 1"=50'-0"



SECTION D-D
SCALE: 1"=20'



SECTION E-E
SCALE: 1"=20'

NEW HOGAN RESERVOIR
CALAVERAS RIVER, CALIFORNIA

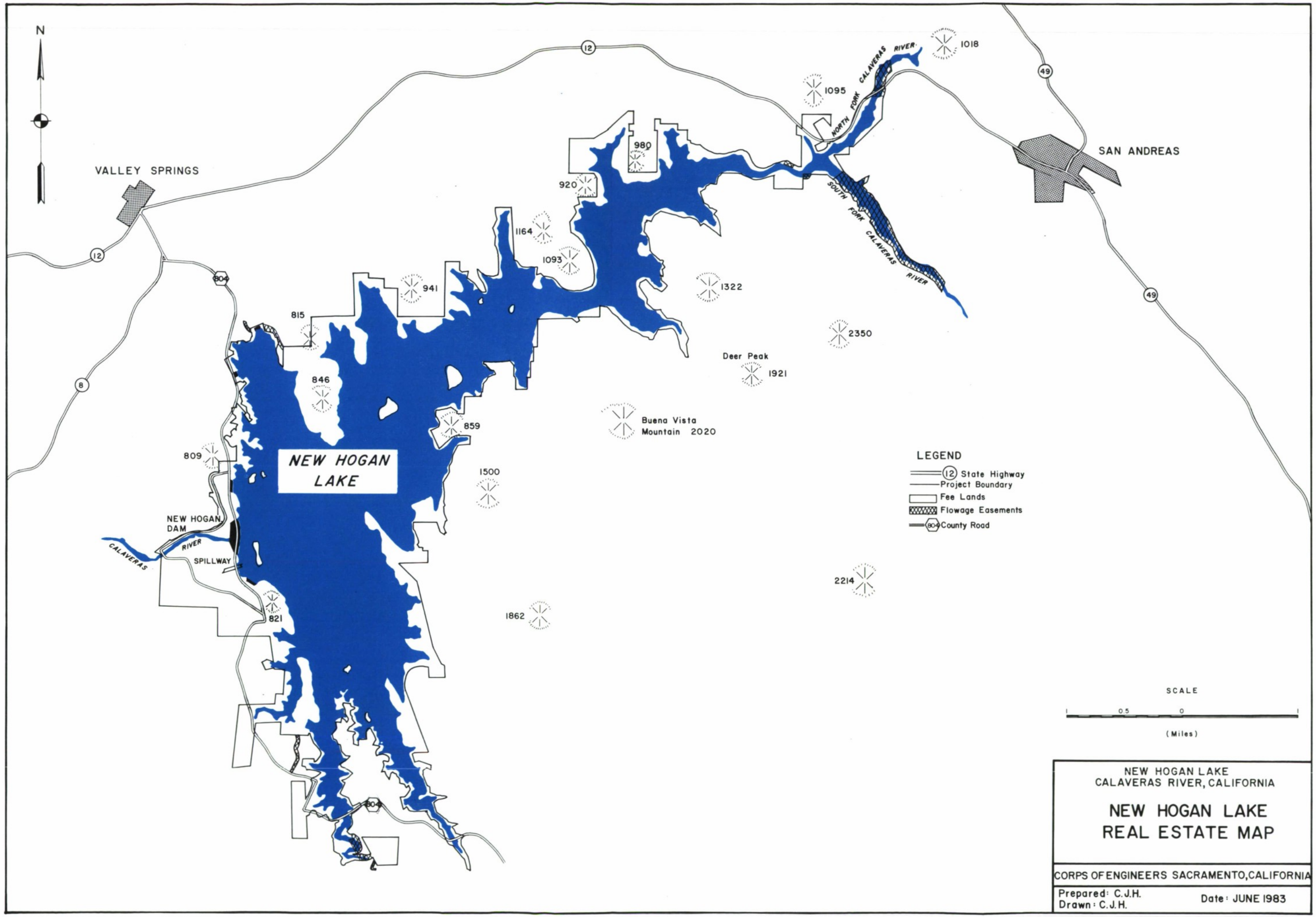
NEW HOGAN SPILLWAY

PLAN, ELEVATION AND SECTIONS

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: T.G.K.
Drawn: C.J.H.
Date: JUNE 1963

PLATE 7



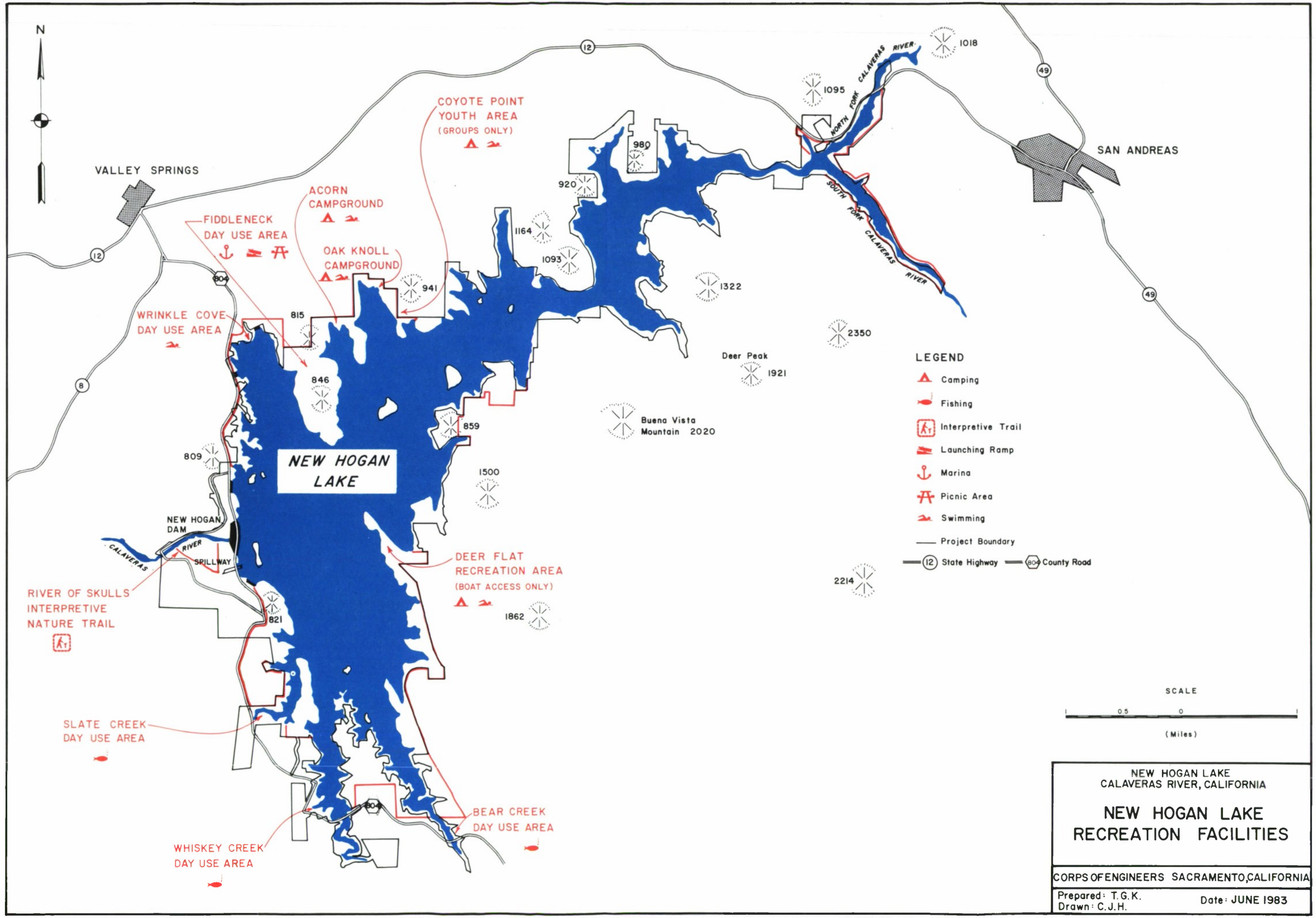
NEW HOGAN LAKE
CALAVERAS RIVER, CALIFORNIA

NEW HOGAN LAKE
REAL ESTATE MAP

CORPS OF ENGINEERS SACRAMENTO, CALIFORNIA

Prepared: C.J.H.
Drawn: C.J.H.
Date: JUNE 1983

PLATE 8



NEW HOGAN LAKE
CALAVERAS RIVER, CALIFORNIA

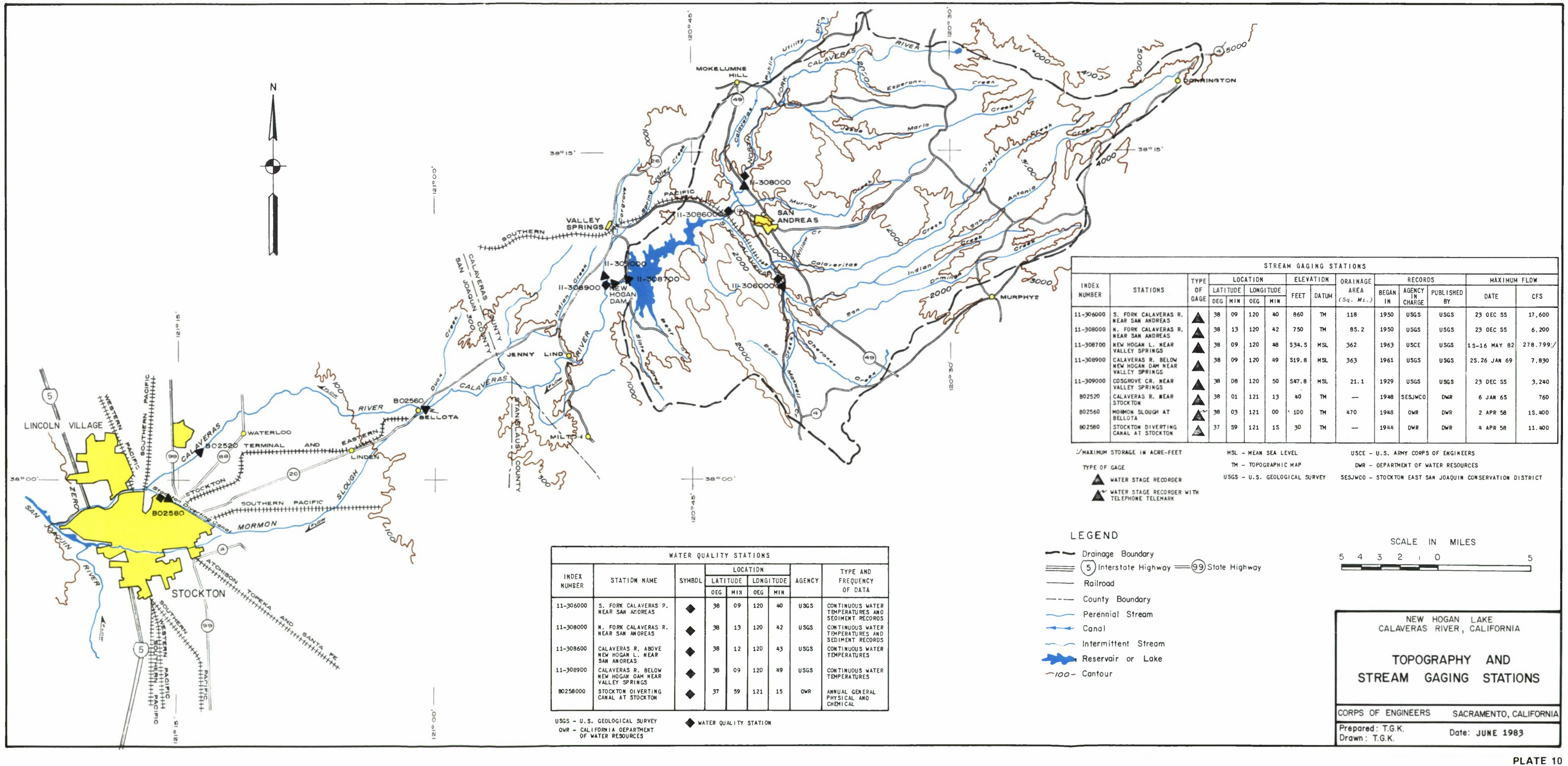
NEW HOGAN LAKE RECREATION FACILITIES

CORPS OF ENGINEERS SACRAMENTO, CALIFORNIA

Prepared: T.G.K.
Drawn: C.J.H.

Date: JUNE 1983

PLATE 9



STREAM GAGING STATIONS

INDEX NUMBER	STATIONS	TYPE OF GAGE	LOCATION LATITUDE DEG	LOCATION LATITUDE MIN	LOCATION LONGITUDE DEG	LOCATION LONGITUDE MIN	ELEVATION FEET	ELEVATION DATUM	DRAINAGE AREA (Sq. Mi.)	RECORDS BEGAN IN	RECORDS AGENCY IN CHARGE	RECORDS PUBLISHED BY	MAXIMUM FLOW DATE	MAXIMUM FLOW CFS
11-306000	S. FORK CALAVERAS R. NEAR SAN ANDREAS	▲	38	09	120	40	860	TM	118	1950	USGS	USGS	23 DEC 55	17,600
11-308000	N. FORK CALAVERAS R. NEAR SAN ANDREAS	▲	38	13	120	42	750	TM	85.2	1950	USGS	USGS	23 DEC 55	6,200
11-308700	NEW HOGAN L. NEAR VALLEY SPRINGS	▲	38	09	120	48	534.5	MSL	362	1963	USCE	USGS	15-16 MAY 82	278,799/
11-308900	CALAVERAS R. BELOW NEW HOGAN DAM NEAR VALLEY SPRINGS	▲	38	09	120	49	519.8	MSL	363	1961	USGS	USGS	25,26 JAN 69	7,830
11-309000	COSGROVE CR. NEAR VALLEY SPRINGS	▲	38	08	120	50	547.8	MSL	21.1	1929	USGS	USGS	23 DEC 55	3,240
B02520	CALAVERAS R. NEAR STOCKTON	▲	38	01	121	13	40	TM	—	1948	SESJWCO	DWR	6 JAN 65	760
B02560	MORMON SLOUGH AT BELLOTA	▲	38	03	121	00	100	TM	470	1948	DWR	DWR	2 APR 58	15,800
B02580	STOCKTON DIVERTING CANAL AT STOCKTON	▲	37	59	121	15	30	TM	—	1944	DWR	DWR	4 APR 58	11,400

/MAXIMUM STORAGE IN ACRE-FEET

MSL - MEAN SEA LEVEL
TM - TOPOGRAPHIC MAP
USGS - U.S. GEOLOGICAL SURVEY
USCE - U.S. ARMY CORPS OF ENGINEERS
DWR - DEPARTMENT OF WATER RESOURCES
SESJWCO - STOCKTON EAST SAN JOAQUIN CONSERVATION DISTRICT

TYPE OF GAGE
▲ WATER STAGE RECORDER
▲T WATER STAGE RECORDER WITH TELEPHONE TELEMARK

WATER QUALITY STATIONS

INDEX NUMBER	STATION NAME	SYMBOL	LOCATION LATITUDE DEG	LOCATION LATITUDE MIN	LOCATION LONGITUDE DEG	LOCATION LONGITUDE MIN	AGENCY	TYPE AND FREQUENCY OF DATA
11-306000	S. FORK CALAVERAS R. NEAR SAN ANDREAS	◆	38	09	120	40	USGS	CONTINUOUS WATER TEMPERATURES AND SEDIMENT RECORDS
11-308000	N. FORK CALAVERAS R. NEAR SAN ANDREAS	◆	38	13	120	42	USGS	CONTINUOUS WATER TEMPERATURES AND SEDIMENT RECORDS
11-308600	CALAVERAS R. ABOVE NEW HOGAN L. NEAR SAN ANDREAS	◆	38	12	120	43	USGS	CONTINUOUS WATER TEMPERATURES
11-308900	CALAVERAS R. BELOW NEW HOGAN DAM NEAR VALLEY SPRINGS	◆	38	09	120	49	USGS	CONTINUOUS WATER TEMPERATURES
80258000	STOCKTON DIVERTING CANAL AT STOCKTON	◆	37	59	121	15	OWR	ANNUAL GENERAL PHYSICAL AND CHEMICAL

USGS - U.S. GEOLOGICAL SURVEY
OWR - CALIFORNIA DEPARTMENT OF WATER RESOURCES
◆ WATER QUALITY STATION

LEGEND
- Drainage Boundary
- (5) Interstate Highway
- (99) State Highway
- Railroad
- County Boundary
- Perennial Stream
- Canal
- Intermittent Stream
- Reservoir or Lake
- 100 Contour

SCALE IN MILES
5 4 3 2 1 0 5

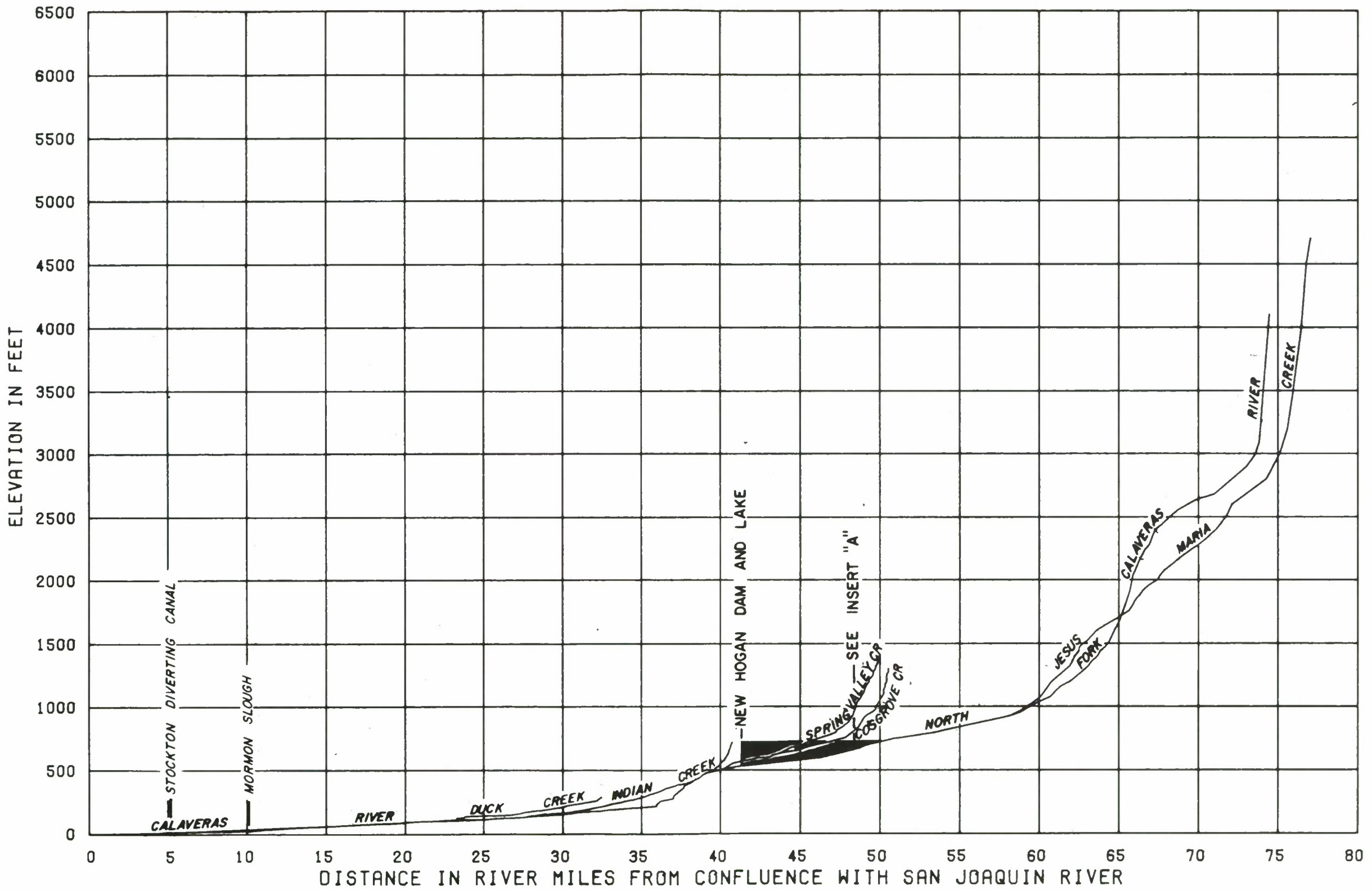
NEW HOGAN LAKE
CALAVERAS RIVER, CALIFORNIA

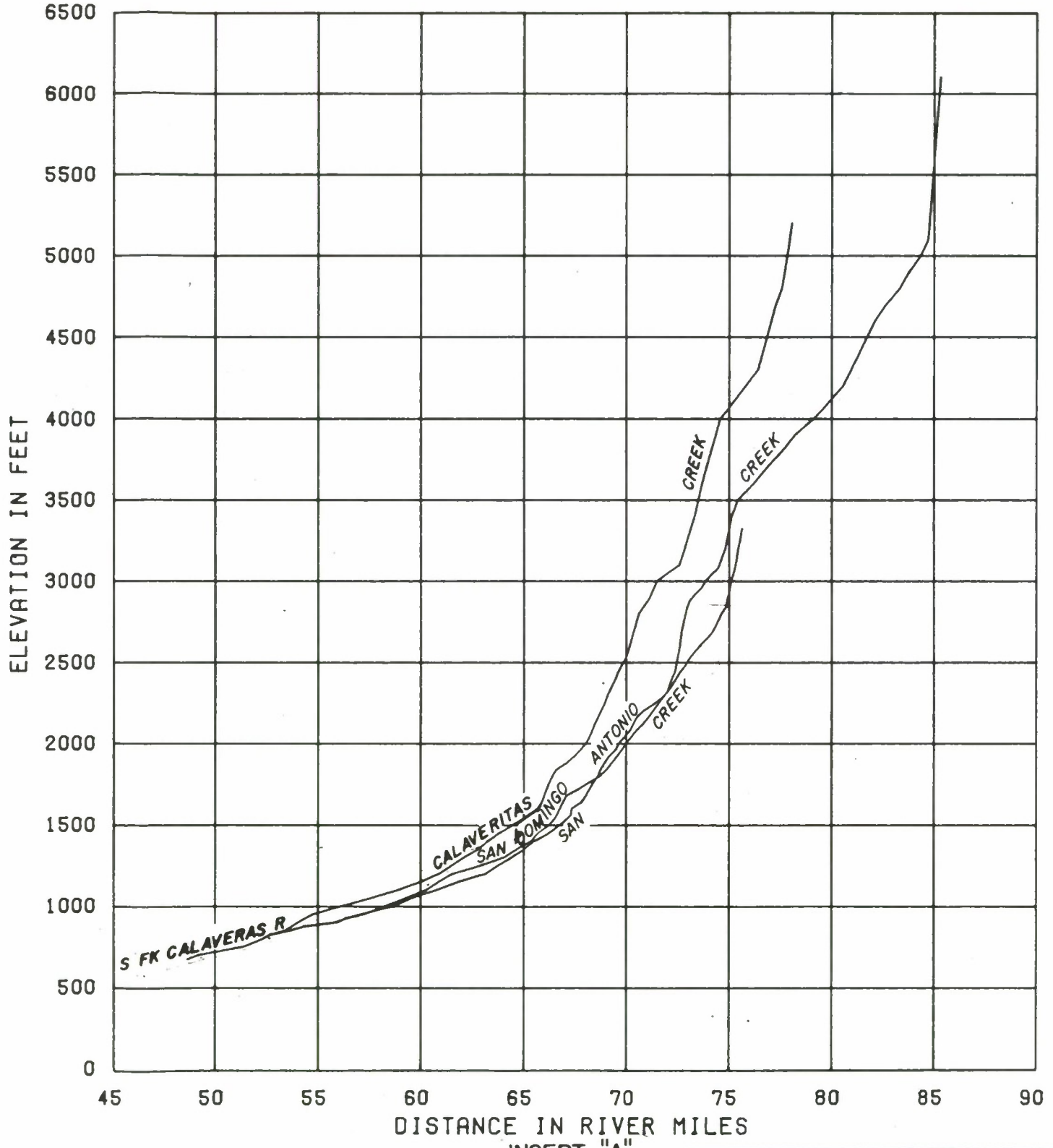
TOPOGRAPHY AND STREAM GAGING STATIONS

CORPS OF ENGINEERS SACRAMENTO, CALIFORNIA

Prepared: T.G.K.
Drawn: T.G.K.
Date: JUNE 1983

PLATE 10





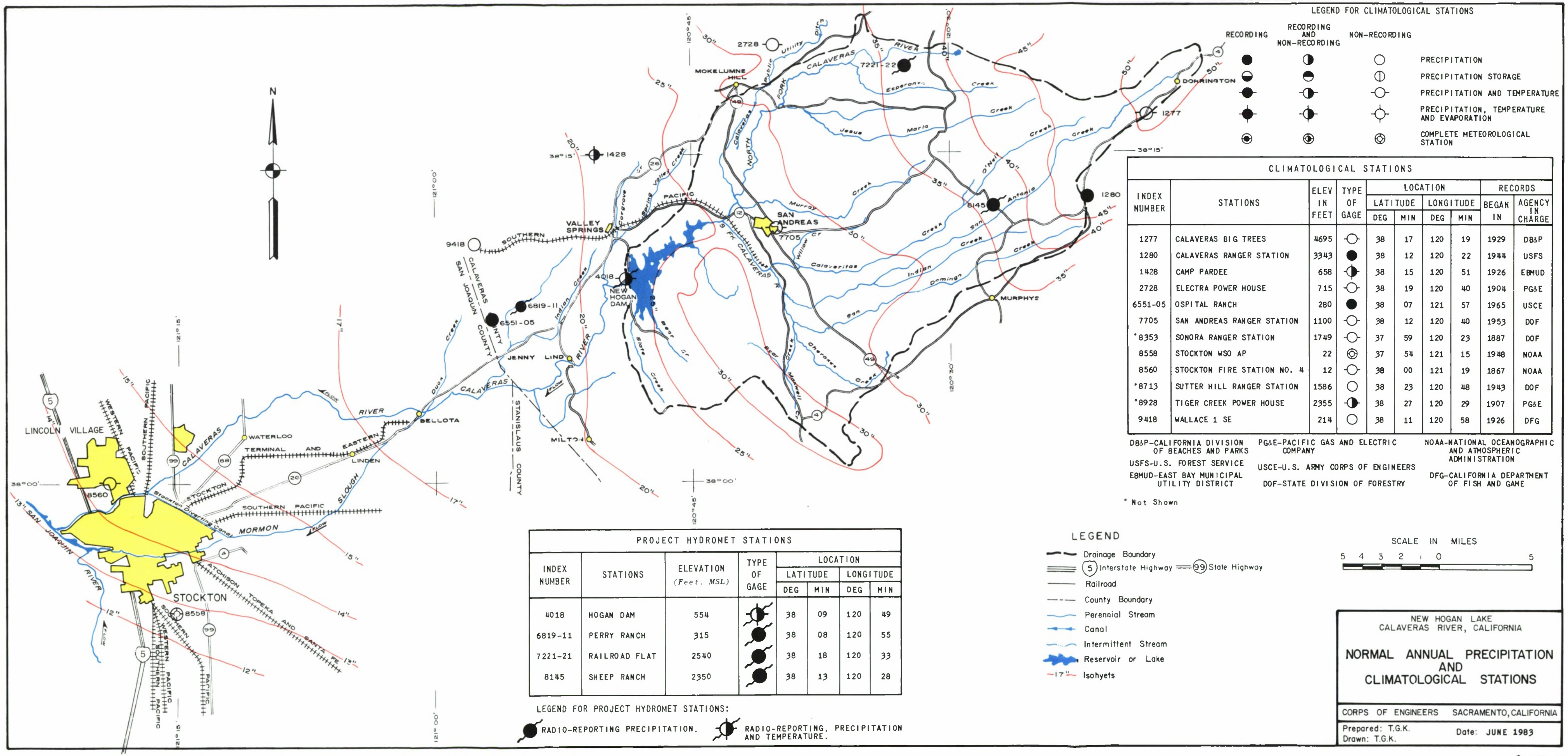
NEW HOGAN LAKE
CALAVERAS RIVER, CALIFORNIA

STREAM PROFILES

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: DJH, TGK
Drawn: CAL-COMP
Date: JUNE 1983

PLATE 11



LEGEND FOR CLIMATOLOGICAL STATIONS

RECORDING	RECORDING AND NON-RECORDING	NON-RECORDING	
●	◑	○	PRECIPITATION
◒	◓	◯	PRECIPITATION STORAGE
●	◑	○	PRECIPITATION AND TEMPERATURE
✦	✦	✦	PRECIPITATION, TEMPERATURE AND EVAPORATION
⊙	⊙	⊙	COMPLETE METEOROLOGICAL STATION

CLIMATOLOGICAL STATIONS

INDEX NUMBER	STATIONS	ELEV IN FEET	TYPE OF GAGE	LOCATION				RECORDS	
				LATITUDE		LONGITUDE		BEGAN IN	AGENCY IN CHARGE
				DEG	MIN	DEG	MIN		
1277	CALAVERAS BIG TREES	4695	○	38	17	120	19	1929	DB&P
1280	CALAVERAS RANGER STATION	3343	●	38	12	120	22	1944	USFS
1428	CAMP PARDEE	658	◑	38	15	120	51	1926	EBMUD
2728	ELECTRA POWER HOUSE	715	○	38	19	120	40	1904	PG&E
6551-05	OSPITAL RANCH	280	●	38	07	121	57	1965	USCE
7705	SAN ANDREAS RANGER STATION	1100	○	38	12	120	40	1953	DOF
*8353	SONORA RANGER STATION	1749	○	37	59	120	23	1887	DOF
8558	STOCKTON WSO AP	22	◎	37	54	121	15	1948	NOAA
8560	STOCKTON FIRE STATION NO. 4	12	○	38	00	121	19	1867	NOAA
*8713	SUTTER HILL RANGER STATION	1586	○	38	23	120	48	1943	DOF
*8928	TIGER CREEK POWER HOUSE	2355	◑	38	27	120	29	1907	PG&E
9418	WALLACE 1 SE	214	○	38	11	120	58	1926	DFG

DB&P-CALIFORNIA DIVISION OF BEACHES AND PARKS
USFS-U.S. FOREST SERVICE
EBMUD-EAST BAY MUNICIPAL UTILITY DISTRICT
PG&E-PACIFIC GAS AND ELECTRIC COMPANY
USCE-U.S. ARMY CORPS OF ENGINEERS
DOF-STATE DIVISION OF FORESTRY
NOAA-NATIONAL OCEANOGRAPHIC AND ATMOSPHERIC ADMINISTRATION
DFG-CALIFORNIA DEPARTMENT OF FISH AND GAME

* Not Shown

PROJECT HYDROMET STATIONS

INDEX NUMBER	STATIONS	ELEVATION (Feet, MSL)	TYPE OF GAGE	LOCATION			
				LATITUDE		LONGITUDE	
				DEG	MIN	DEG	MIN
4018	HOGAN DAM	554	◑	38	09	120	49
6819-11	PERRY RANCH	315	●	38	08	120	55
7221-21	RAILROAD FLAT	2540	●	38	18	120	33
8145	SHEEP RANCH	2350	●	38	13	120	28

LEGEND FOR PROJECT HYDROMET STATIONS:
● RADIO-REPORTING PRECIPITATION.
◑ RADIO-REPORTING, PRECIPITATION AND TEMPERATURE.

LEGEND
- Drainage Boundary
- (5) Interstate Highway — (99) State Highway
- Railroad
- County Boundary
- Perennial Stream
- Canal
- Intermittent Stream
- Reservoir or Lake
- 17" Isohyets

SCALE IN MILES
5 4 3 2 1 0 5

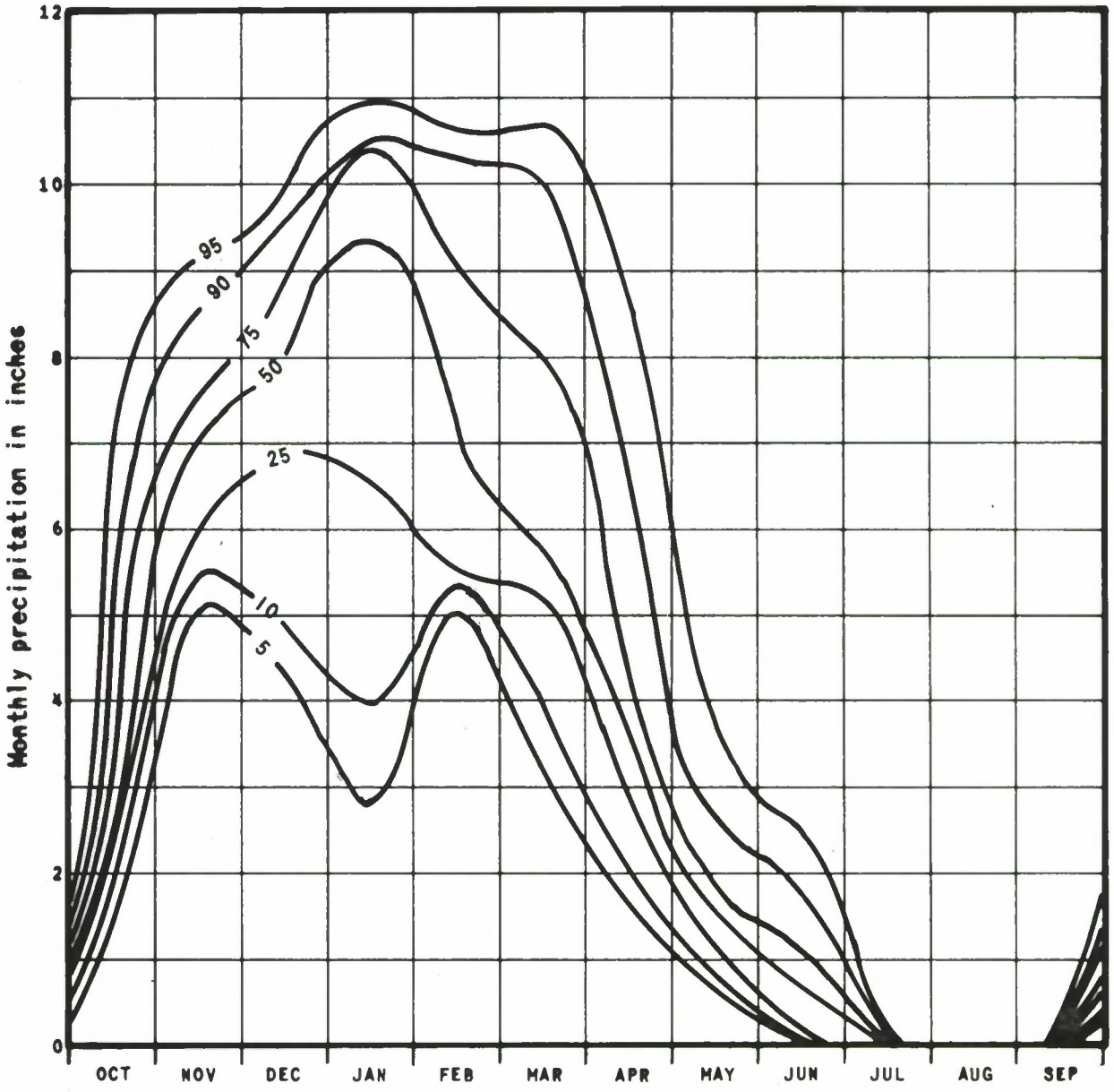
NEW HOGAN LAKE
CALAVERAS RIVER, CALIFORNIA

NORMAL ANNUAL PRECIPITATION AND CLIMATOLOGICAL STATIONS

CORPS OF ENGINEERS SACRAMENTO, CALIFORNIA

Prepared: T.G.K.
Drawn: T.G.K.
Date: JUNE 1983

PLATE 12



NOTE:

Parameter is percent of time precipitation is less than indicated amount.

NEW HOGAN LAKE
CALAVERAS RIVER, CALIFORNIA

SEASONAL VARIATION
OF RAINFALL FREQUENCY

CALAVERAS RIVER BASIN

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: T.G.K.
Drawn: C.J.H.
Date: JUNE 1983

PLATE 13

LEGEND:

- 5 Interstate Highway
- 8 State Highway
- 12 County Highway
- Railroad
- 100 Year Flood 12,500 c.f.s. at Bellota
- Standard Project Flood

NOTE:

Standard Project Flood Plain taken from data developed for Flood Insurance Rate Maps, San Joaquin County, CA, 1980.

SCALE

1 0.5 0 1

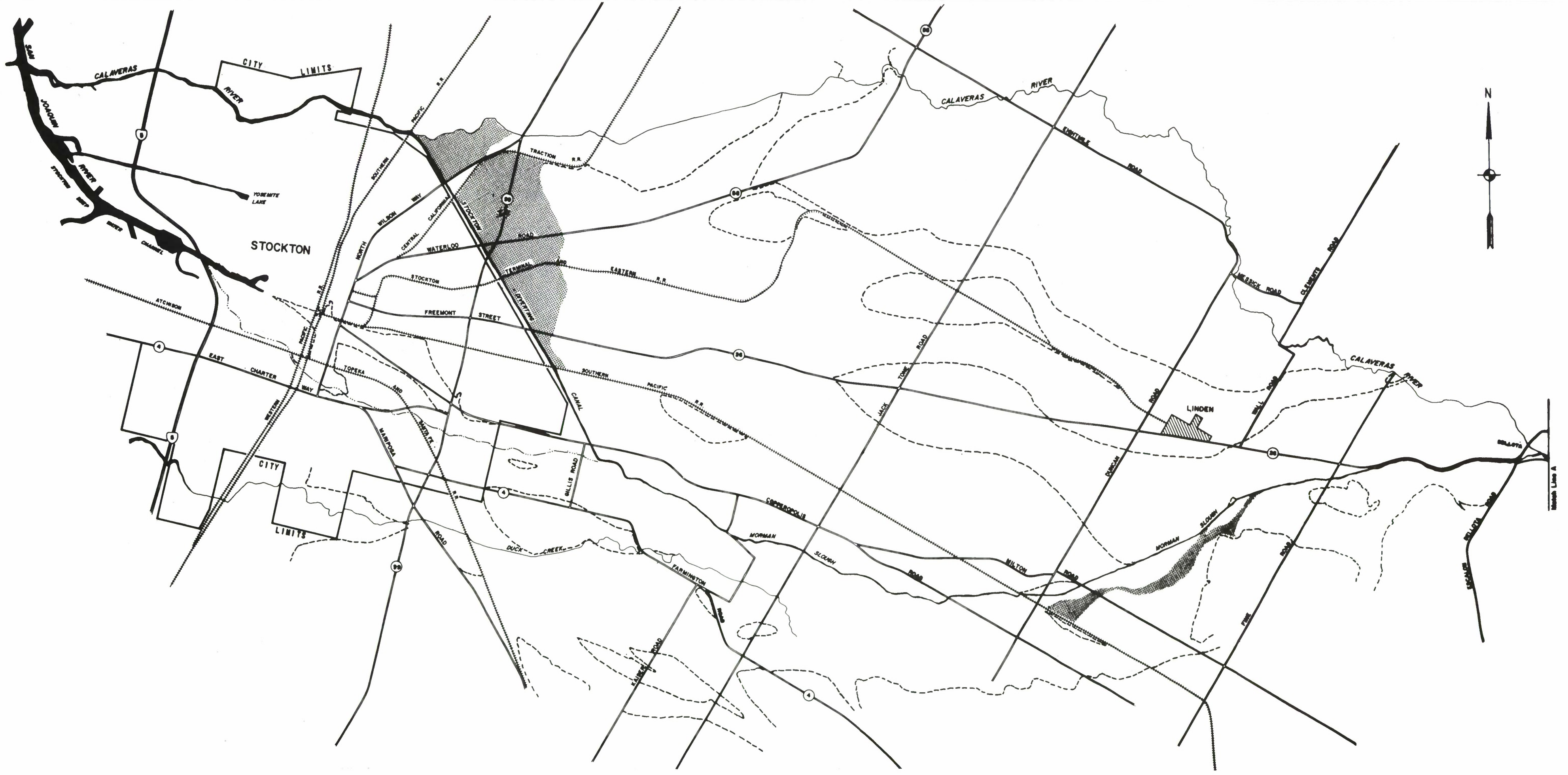
(Miles)

NEW HOGAN LAKE
CALAVERAS RIVER, CALIFORNIA

AREAS SUBJECT TO FLOODING
LOWER CALAVERAS RIVER
(PROJECT CONDITION)

CORPS OF ENGINEERS SACRAMENTO, CALIFORNIA

Prepared: D.J.H.,C.J.H.
Drawn: C.J.H.
Date: JUNE 1983



LEGEND:

- (5) Interstate Highway
- (8) State Highway
- (12) County Highway
- Railroad
- 100 Year Flood 12,500 c.f.s. at Bellota
- Standard Project Flood

NOTE:

Standard Project Flood Plain taken from data developed for Flood Insurance Rate Maps, San Joaquin County, CA, 1980.

SCALE

1 0.5 0 1

(Miles)

NEW HOGAN LAKE
CALAVERAS RIVER, CALIFORNIA

AREAS SUBJECT TO FLOODING LOWER CALAVERAS RIVER (PROJECT CONDITION)

CORPS OF ENGINEERS SACRAMENTO, CALIFORNIA

Prepared: B.J.H., C.J.H. Date: JUNE 1985
Drawn: C.J.H.

PLATE 15

NOTE:

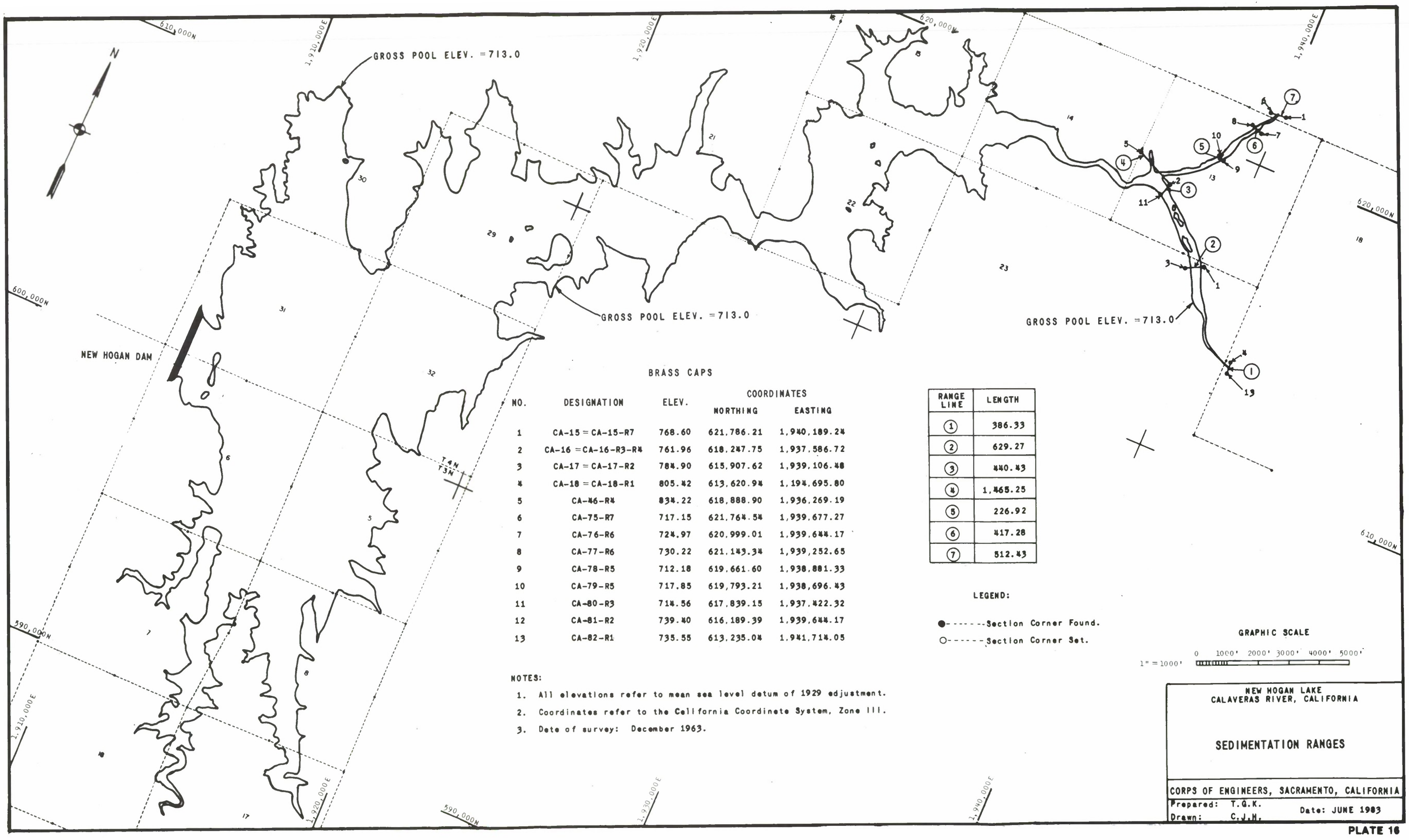
Monthly flows are based on published records of flow data adjusted for the effects of storage and evaporation at Hogan Reservoir and New Hogan Lake, and intervening local flows between the gage and New Hogan Lake.

"No Record.

UNIMPAIRED MONTHLY INFLOWS TO NEW HOGAN LAKE

(1,000 acre-feet)

WATER YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
1907	0.0	0.0	0.0	89.3	99.0	260.9	39.2	14.5	8.6	0.0	0.0	0.0	511.5
1908	0.0	0.0	6.0	19.5	14.1	12.7	5.7	2.9	2.0	0.0	0.0	0.0	62.9
1909	0.0	1.6	5.1	148.9	104.5	46.2	20.6	6.3	3.1	0.8	0.2	0.1	337.4
1910	0.8	11.0	47.0	45.2	13.8	36.5	11.3	5.2	1.9	0.5	0.0	0.0	173.2
1911	1.3	2.5	3.3	216.5	70.4	151.7	32.7	11.5	5.0	2.1	0.7	0.9	498.6
1912	2.2	3.2	4.4	10.1	4.8	13.9	7.9	6.9	3.7	0.4	0.1	0.7	58.3
1913	0.9	1.8	2.2	11.2	3.1	3.5	4.3	1.4	0.6	0.1	0.0	0.0	29.1
1914	0.0	0.4	11.3	104.5	63.2	16.3	8.7	4.2	1.9	0.6	0.0	0.0	211.1
1915	2.7	3.0	19.6	39.8	114.7	20.4	10.6	11.5	3.4	0.6	0.0	0.3	226.6
1916	0.4	0.4	7.6	120.3	42.6	76.5	17.3	7.2	3.1	0.9	0.1	0.1	276.5
1917	2.4	2.5	18.4	37.2	122.1	46.0	21.6	18.7	3.8	0.6	0.0	0.1	273.3
1918	0.1	0.9	1.9	3.1	24.3	12.4.0	7.4	2.2	0.0	0.0	0.0	0.0	163.9
1919	0.3	1.3	2.7	37.5	29.6	7.1	2.8	1.6	0.6	0.0	0.0	0.1	86.0
1920	0.2	0.4	3.8	0.8	3.3	48.3	14.4	5.4	1.3	0.7	0.2	0.0	76.8
1921	0.5	6.0	26.7	100.8	29.6	23.1	6.8	4.0	1.2	0.0	0.0	0.0	198.7
1922	0.0	0.1	12.7	13.9	100.8	38.8	26.7	8.4	2.2	0.4	0.0	0.4	204.0
1923	0.2	5.1	59.1	30.7	24.3	9.7	18.3	6.9	2.4	0.6	0.2	0.3	157.8
1924	.	.	.	.	.	.	.	.	.	.	.	.	16.7
1925	0.0	2.4	8.0	5.8	76.6	11.2	35.8	5.8	1.5	0.2	0.0	0.0	147.3
1926	0.1	0.9	1.9	2.2	36.1	4.3	13.4	1.3	0.2	0.0	0.0	0.0	60.4
1927	0.0	16.4	4.3	12.0	75.0	15.6	38.0	4.4	1.6	0.2	0.0	0.0	167.5
1928	0.3	2.9	7.4	4.7	19.0	62.5	19.8	12.9	3.2	0.9	0.1	0.0	120.8
1929	0.0	0.9	2.7	4.6	10.6	8,4	7.4	1.6	1.4	0.0	0.0	0.0	37.6
1930	0.0	0.0	0.2	11.5	10.7	33.9	2.6	2.2	0.4	0.3	0.1	0.1	62.0
1931	0.3	0.1	1.2	4.0	4.3	3.1	0.7	0.2	0.1	0.1	0.0	0.0	14.1
1932	0.0	0.0	37.3	21.7	55.0	7.9	3.4	3.6	0.7	0.0	0.0	0.5	129.6
1933	0.0	0.0	0.0	10.5	6.3	8.1	3.0	3.5	0.5	0.1	0.1	0.1	32.2
1934	0.2	0.7	12.0	12.2	20.1	5.7	1.0	0.5	0.1	0.0	0.0	0.1	52.6
1935	0.2	1.3	4.1	32.1	7.6	31.0	54.5	8.3	2.5	1.6	0.1	0.4	143.8
1936	0.0	0.3	0.8	27.7	182.8	20.1	25.2	4.9	3.9	0.7	0.1	0.1	288.6
1937	0.0	0.3	2.5	11.4	91.5	75.8	23.5	7.6	2.7	1.0	0.1	0.4	216.8
1938	0.0	0.6	18.2	14.8	148.3	119.2	29.8	14.9	4.6	1.9	0.4	0.2	352.9
1939	1.2	2.1	2.5	0.0	5.6	5.0	3.1	1.8	0.3	0.5	0.1	0.1	22.3
1940	0.0	0.0	0.8	43.2	62.6	59.1	23.2	5.1	1.6	0.2	0.1	0.8	196.7
1941	0.0	1.4	17.9	22.4	46.7	46.7	45.9	7.2	2.8	0.8	0.2	0.1	192.1
1942	0.2	1.1	15.5	64.7	35.0	19.1	27.5	19.0	6.2	1.8	0.3	0.1	190.5
1943	0.4	9.2	17.8	60.5	37.6	102.8	18.0	7.4	3.5	1.5	0.2	0.1	259.0
1944	0.6	1.4	2.4	5.6	23.7	29.7	6.3	3.5	1.3	0.1	0.1	0.1	74.8
1945	0.0	11.2	8.2	4.9	63.2	39.1	14.0	5.1	2.4	0.2	0.1	0.1	148.5
1946	0.0	4.2	41.6	13.7	8.1	17.6	14.8	4.0	1.7	0.6	0.5	0.1	106.9
1947	0.5	5.9	6.0	3.4	9.3	15.5	5.5	1.3	0.7	0.1	0.1	0.1	48.4
1948	0.2	1.4	1.4	2.2	3.9	22.3	35.4	9.1	2.8	0.3	0.1	0.1	79.2
1949	0.0	0.5	2.8	3.9	10.4	47.1	8,5	3.3	0.2	0.1	0.1	0.1	77.2
1950	0.0	1.0	1.4	30.8	39.0	17.6	21.3	5.2	1.5	0.6	0.3	0.1	118.8
1951	0.7	59.2	75.8	55.2	29.3	43.7	9.8	8.7	1.9	0.7	0.1	0.1	285.2
1952	0.2	3.4	36.4	102.8	43.1	91.5	25.9	12.5	4.0	2.2	0.6	0.4	323.0
1953	0.7	1.6	11.9	32.2	5.5	13.4	9.3	6.0	3.6	0.5	0.3	0.1	85.1
1954	0.5	1.6	2.9	8.1	16.4	29.0	11.7	3.7	1.1	0.7	0.3	0.1	76.1
1955	0.0	0.9	13.8	32.9	13.7	10.0	7.6	5.9	0.8	0.5	0.2	0.1	86.4
1956	0.0	0.2	127.2	105.4	27.5	15.1	9.8	14.8	2.7	0.8	0.5	0.2	304.2
1957	0.6	1.4	2.2	4.0	11.6	31.1	5.5	11.3	2.1	0.6	0.3	0.1	70.8
1958	0.1	0.8	4.0	19.3	72.3	80.6	140.8	11.8	4.5	1.5	0.6	0.2	336.5
1959	0.4	0.9	1.6	7.3	35.9	5.4	2.7	1.4	0.3	0.1	0.1	0.1	56.2
1960	0.1	0.1	0.7	3.2	23.3	7.2	4.4	2.7	0.4	0.1	0.1	0.0	42.3



BRASS CAPS

NO.	DESIGNATION	ELEV.	COORDINATES NORTHING	COORDINATES EASTING
1	CA-15 = CA-15-R7	768.60	621,786.21	1,940,189.24
2	CA-16 = CA-16-R3-R4	761.96	618,247.75	1,937,586.72
3	CA-17 = CA-17-R2	784.90	615,907.62	1,939,106.48
4	CA-18 = CA-18-R1	805.42	613,620.94	1,194,695.80
5	CA-46-R4	834.22	618,888.90	1,936,269.19
6	CA-75-R7	717.15	621,764.54	1,939,677.27
7	CA-76-R6	724.97	620,999.01	1,939,644.17
8	CA-77-R6	730.22	621,143.34	1,939,252.65
9	CA-78-R5	712.18	619,661.60	1,938,881.33
10	CA-79-R5	717.85	619,793.21	1,938,696.43
11	CA-80-R3	714.56	617,839.15	1,937,422.32
12	CA-81-R2	739.40	616,189.39	1,939,644.17
13	CA-82-R1	735.55	613,235.04	1,941,714.05

RANGE LINE	LENGTH
1	386.33
2	629.27
3	440.43
4	1,465.25
5	226.92
6	417.28
7	512.43

NOTES:

1. All elevations refer to mean sea level datum of 1929 adjustment.
2. Coordinates refer to the California Coordinate System, Zone III.
3. Date of survey: December 1963.

LEGEND:

●------Section Corner Found.

○------Section Corner Set.

GRAPHIC SCALE

1" = 1000' 0 1000' 2000' 3000' 4000' 5000'

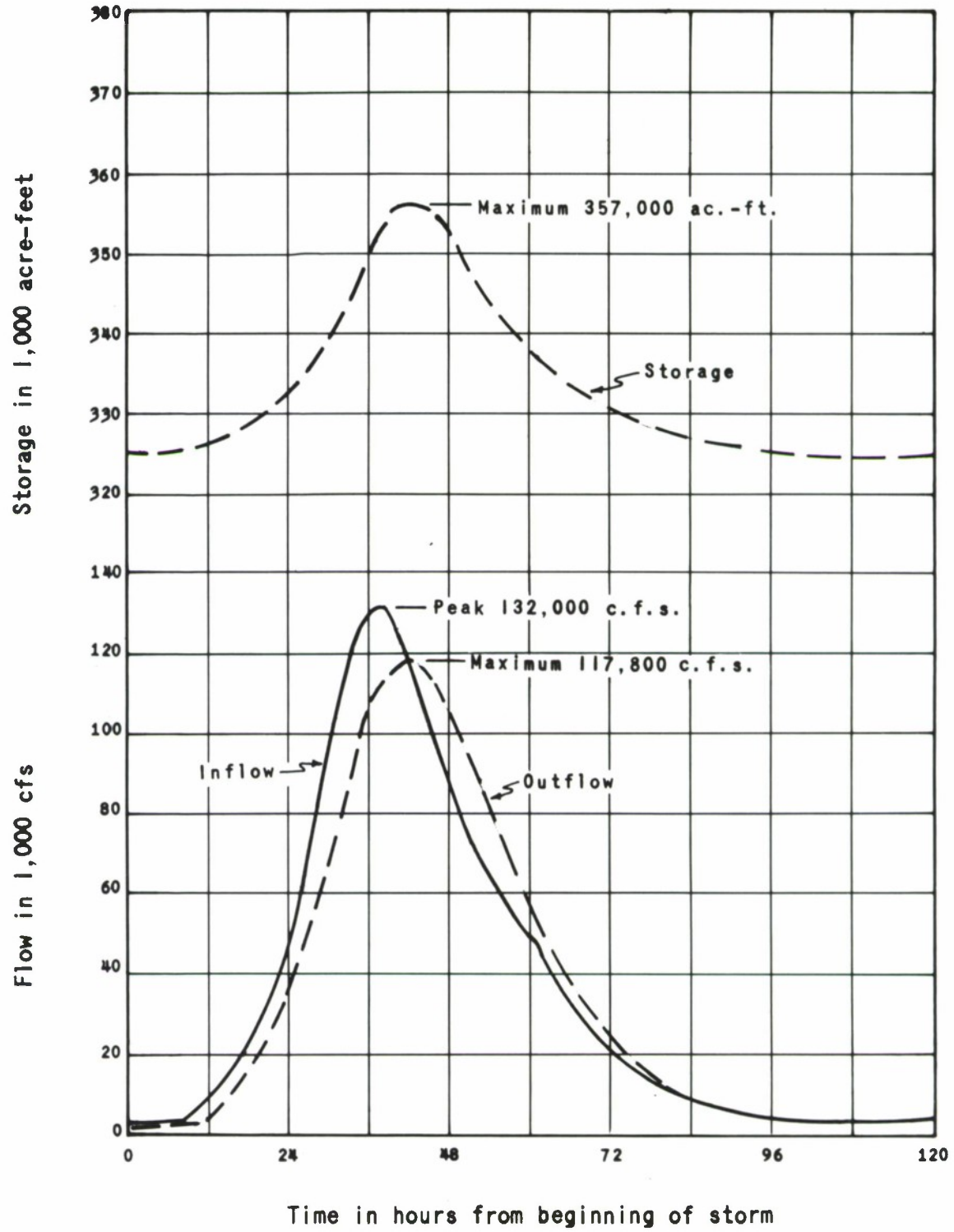
NEW HOGAN LAKE
CALAVERAS RIVER, CALIFORNIA

SEDIMENTATION RANGES

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: T.Q.K.
Drawn: C.J.H.
Date: JUNE 1983

PLATE 16



NOTE:

Reservoir at gross pool elevation 713.0 feet, storage 325,000 acre-feet, at beginning of spillway design flood.

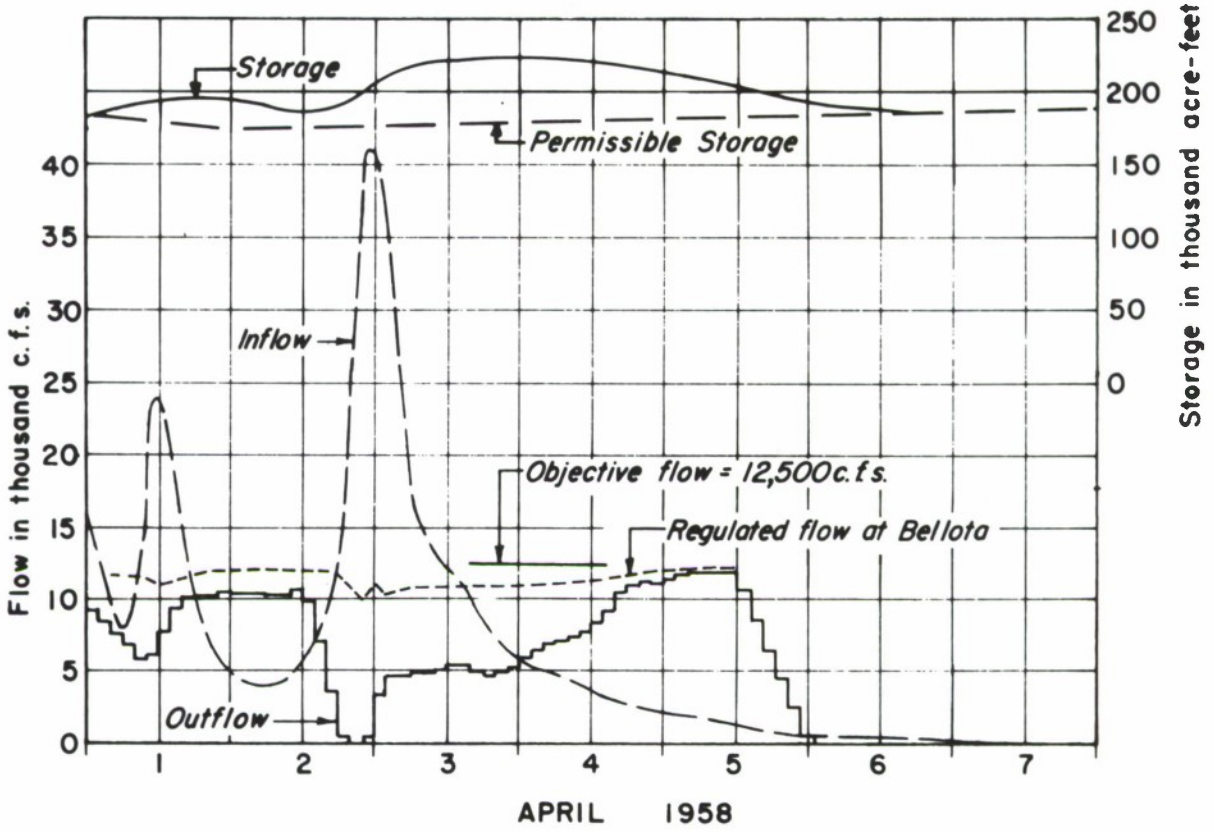
NEW HOGAN LAKE
CALAVERAS RIVER, CALIFORNIA

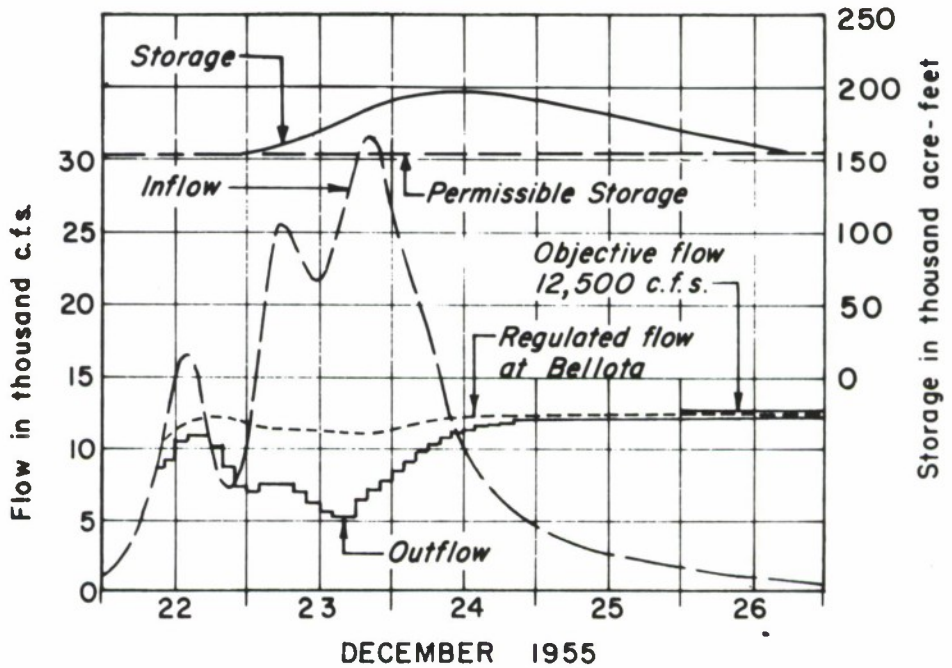
SPILLWAY DESIGN FLOOD HYDROGRAPHS

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: D.J.H.
Drawn: C.J.H.
Date: JUNE 1983

PLATE 17





NOTE:

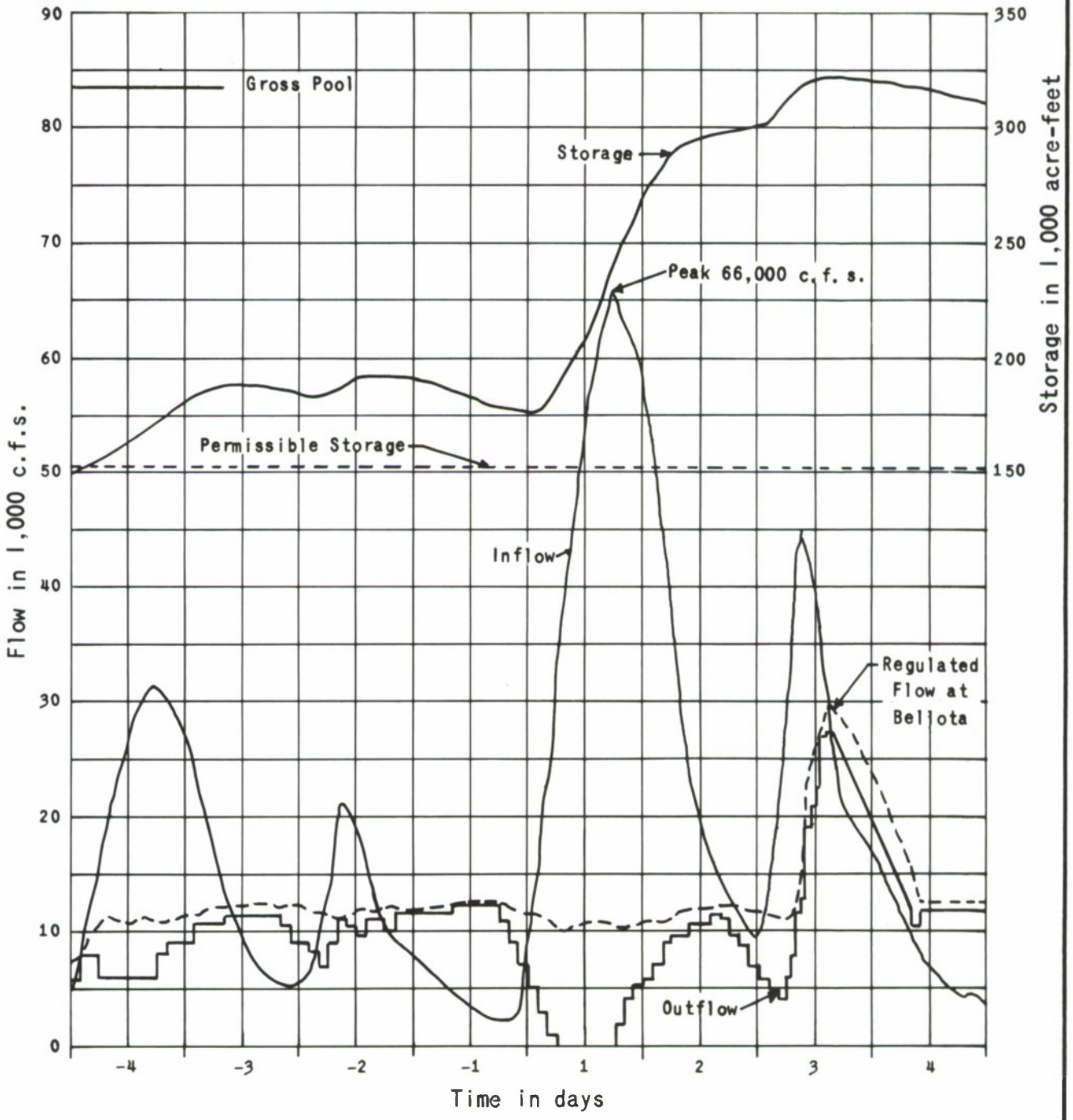
All routings are based on criteria shown on Charts A-9 and A-10.

NEW HOGAN LAKE
CALAVERAS RIVER, CALIFORNIA

FLOOD ROUTINGS

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: R.L.L.
Drawn: C.J.J.
Date: JUNE 1983



STANDARD PROJECT FLOOD

NOTE:

All routings are based on criteria shown on Charts A-9 and A-10.

NEW HOGAN LAKE
CALAVERAS RIVER, CALIFORNIA

FLOOD ROUTINGS

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: R.L.L.
Drawn: C.J.J.
Date: JUNE 1983

ANNUAL MAXIMUM RAIN FLOOD FLOWS
CALAVERAS RIVER BELOW NEW HOGAN DAM
UNREGULATED CONDITION

(Flows in cfs)

WATER YEAR	PEAK		1-DAY		3-DAY		7-DAY		15-DAY		30-DAY	
	DATE	FLOW	DATE	FLOW	DATE	FLOW	DATE	FLOW	DATE	FLOW	DATE	FLOW
1930	5 Mar	10,500	5 Mar	5,700	4 Mar	3,730	4 Mar	1,800				
1931	15 Feb	860	15 Feb	470	14 Feb	330	14 Feb	280	14 Feb	120	14 Fab	81
1932	6 Fab	13,000	6 Feb	6,950	6 Fab	4,620	5 Feb	2,800	30 Jan	1,830	6 Jan	1,030
1933	29 Jan	2,060	29 Jan	1,120	27 Jan	810	24 Jan	670	19 Jan	370	19 Jan	250
1934	1 Jan	4,800	1 Jan	2,630	30 Dec	1,800	29 Dec	1,160	18 Feb	640	8 Fab	390
1935	7 Mar	11,000	7 Mar	4,960	7 Apr	3,060	3 Apr	2,120	3 Apr	1,440	3 Apr	940
1936	22 Feb	35,000	22 Feb	18,300	21 Feb	11,500	20 Feb	6,320	11 Feb	5,600	1 Feb	3,110
1937	6 Fab	14,000	6 Feb	9,780	4 Feb	7,450	2 Feb	3,990	1 Feb	2,730	28 Jan	1,640
1938	11 Feb	41,000	11 Feb	19,800	10 Feb	12,400	9 Feb	7,230	31 Jan	5,030	31 Jan	2,760
1939	7 Feb	1,780	7 Feb	970	6 Feb	760	6 Fab	500	30 Jan	240	30 Jan	170
1940	27 Feb	18,000	27 Feb	10,000	27 Feb	6,960	25 Fab	4,000	23 Feb	1,850	4 Feb	1,210
1941	4 Apr	10,800	4 Apr	5,890	1 Mar	4,330	28 Feb	2,540	21 Fab	1,620	8 Fab	1,430
1942	27 Jan	18,300	27 Jan	9,940	25 Jan	6,330	24 Jan	4,000	24 Jan	3,050		
1943	6 Mar	14,900	6 Mar	8,120	21 Jan	5,580	5 Mar	4,630	5 Mar	3,150	22 Feb	2,150
1956	23 Oac	31,500	23 Dac	24,000	22 Dec	18,000						
1957	6 Mar	7,912	6 Mar	4,300	5 Mar	2,740	1 Mar	1,460	24 Feb	1,050	23 Feb	680
1958	2 Apr	42,000	3 Apr	15,000			31 Mar	8,890	22 Mar	4,930	15 Mar	3,360
1959	11 Feb	6,640	11 Feb	3,610	17 Feb	2,780	16 Feb	1,710	9 Fab	1,210	9 Feb	680
1964	22 Jan	4,820	22 Jan	2,620	21 Jan	1,830	21 Jan	1,040	20 Jan	610	19 Jan	360
1965	23 Dac	20,600	23 Dac	12,800	22 Dec	8,670	22 Dec	5,500	23 Dec	3,900	19 Dec	2,720
1966	30 Dec	3,720	30 Dac	2,020	29 Oac	1,720	28 Dac	980	25 Dac	630	25 Oac	370
1967	21 Jan	17,500	22 Jan	6,740	21 Jan	3,990	18 Apr	2,900	21 Jan	2,170	31 Mar	1,830
1968	21 Fab	3,040	21 Fab	1,650	20 Feb	1,300	17 Feb	940	16 Feb	560	17 Feb	440
1969	21 Jan	19,300	21 Jan	14,700	20 Jan	9,510	20 Jan	7,000	19 Jan	4,580	19 Jan	3,100
1970			21 Jan	7,200	14 Jan	5,070	16 Jan	3,550	14 Jan	2,850	10 Jan	1,640
1971	2 Dec	5,480	2 Dec	2,980	2 Dec	2,260	29 Nov	1,970	28 Nov	1,180	28 Nov	930
1972	25 Dac	9,050	25 Dec	4,920	25 Dec	2,370	22 Dec	1,480	21 Dec	790	20 Dec	430
1973	16 Jan	13,500	16 Jan	7,700	10 Feb	5,940	10 Feb	3,730	4 Feb	2,270	16 Jan	1,840
1974	2 Mar	18,000	2 Mar	9,120	1 Mar	4,950	1 Mar	2,740	1 Mar	1,720	1 Mar	1,100
1975	25 Mar	9,650	25 Mar	5,780	25 Mar	3,400	21 Mar	2,540	14 Mar	1,730	7 Mar	1,260
1976	2 Mar	440	2 Mar	240	1 Mar	180	29 Fab	130	28 Feb	91	13 Feb	70
1977	16 Mar	200	16 Mar	110	21 Feb	60	21 Feb	40	9 Mar	30	21 Feb	30
1978	5 Mar	10,600	5 Mar	5,770	4 Mar	4,320	14 Jan	2,620	5 Jan	1,730	6 Fab	1,330
1979	22 Feb	9,940	22 Feb	5,400	21 Feb	4,650	19 Feb	2,830	18 Feb	2,180	14 Feb	1,440
1980	14 Jan	17,500	14 Jan	8,650	12 Jan	7,390	12 Jan	4,740	10 Jan	2,630	15 Fab	1,630

COMPUTED STATISTICS

Yaars	36	36	35	34	33	32
Log Mean	3.940	3.665	3.490	3.284	3.091	2.907
Std. Oav.	.525	.519	.521	.500	.526	.508
Skew	-1.452	-1.441	-1.535	-1.586	-1.358	-1.169

ADOPTED STATISTICS

Log Maan	3.965	3.675	3.499	3.302	3,109	2.940
Std. Oev.	.521	.507	.498	.488	.479	.471
Skew	-1.000	-1.000	-1.000	-1.000	-1.000	-1.000

PLATE 19

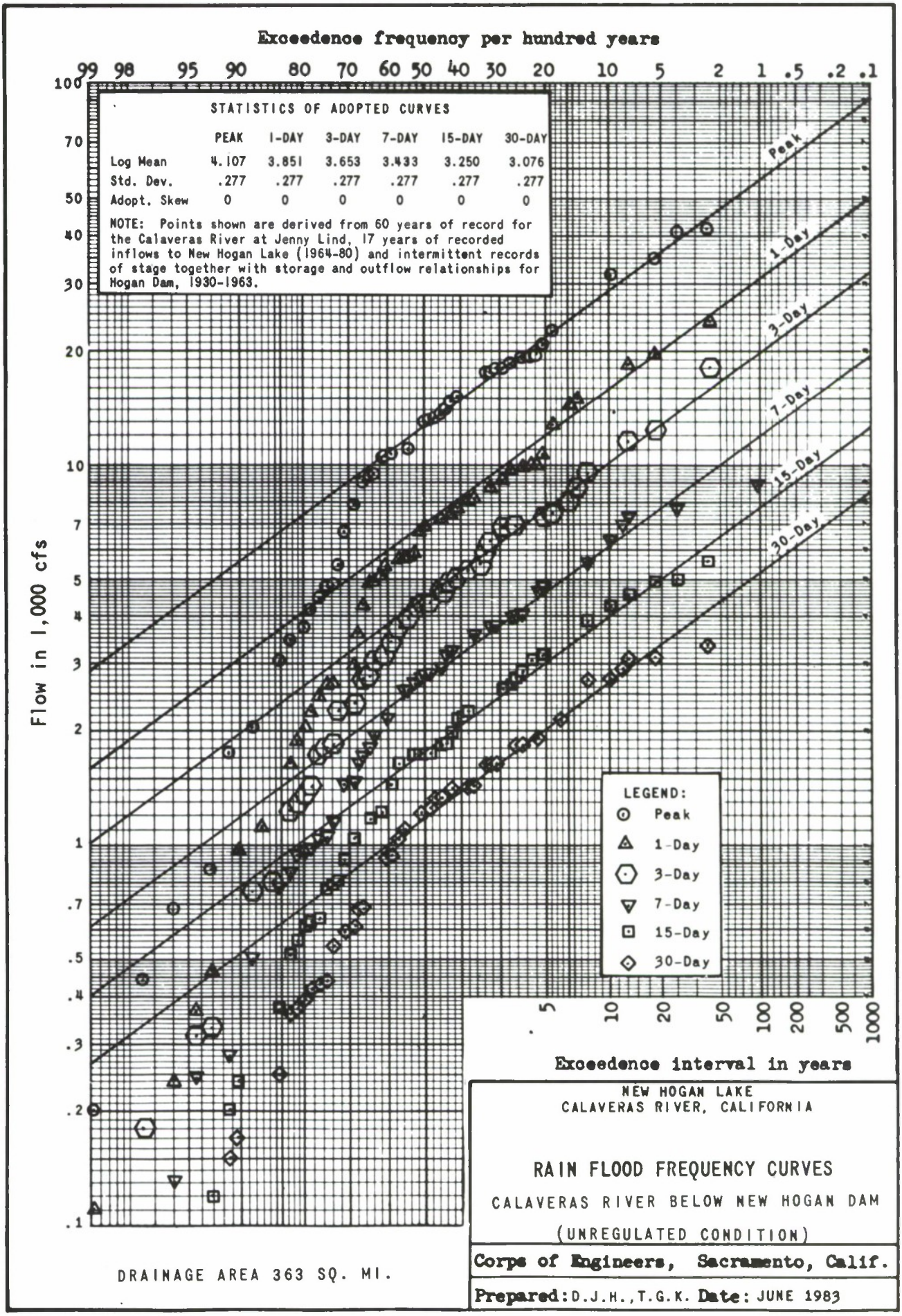
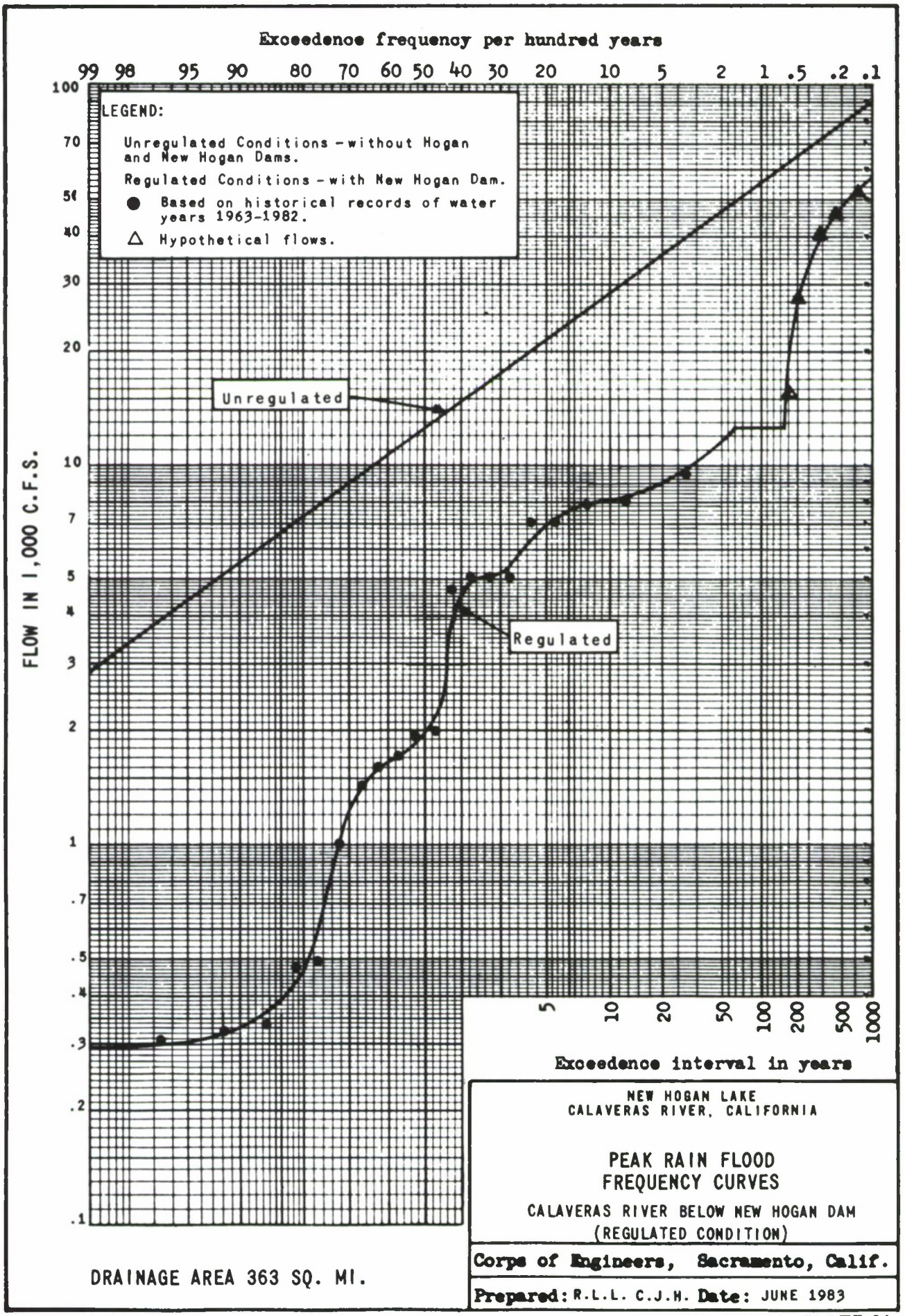

Exceedence frequency per hundred years
99 98 95 90 80 70 60 50 40 30 20 10 5 2 1 .5 .2 .1
100 70 50 40 30 20 10 7 5 4 3 2 1 .7 .5 .4 .3 .2 .1
Flow in 1,000 cfs
STATISTICS OF ADOPTED CURVES
PEAK 1-DAY 3-DAY 7-DAY 15-DAY 30-DAY
Log Mean 4.107 3.851 3.653 3.433 3.250 3.076
Std. Dev. .277 .277 .277 .277 .277 .277
Adopt. Skew 0 0 0 0 0 0
NOTE: Points shown are derived from 60 years of record for the Calaveras River at Jenny Lind, 17 years of recorded inflows to New Hogan Lake (1964-80) and intermittent records of stage together with storage and outflow relationships for Hogan Dam, 1930-1963.
Peak
1-Day
3-Day
7-Day
15-Day
30-Day
LEGEND:
Peak
1-Day
3-Day
7-Day
15-Day
30-Day
5 10 20 50 100 200 500 1000
Exceedence interval in years
DRAINAGE AREA 363 SQ. MI.
NEW HOGAN LAKE
CALAVERAS RIVER, CALIFORNIA
RAIN FLOOD FREQUENCY CURVES
CALAVERAS RIVER BELOW NEW HOGAN DAM
(UNREGULATED CONDITION)
Corps of Engineers, Sacramento, Calif.
Prepared: D.J.H., T.G.K. Date: JUNE 1983

PLATE 20



NEW HOGAN LAKE
CALAVERAS RIVER, CALIFORNIA

PEAK RAIN FLOOD FREQUENCY CURVES

CALAVERAS RIVER BELOW NEW HOGAN DAM
(REGULATED CONDITION)

Corps of Engineers, Sacramento, Calif.

Prepared: R.L.L. C.J.H. Date: JUNE 1983

PLATE 21

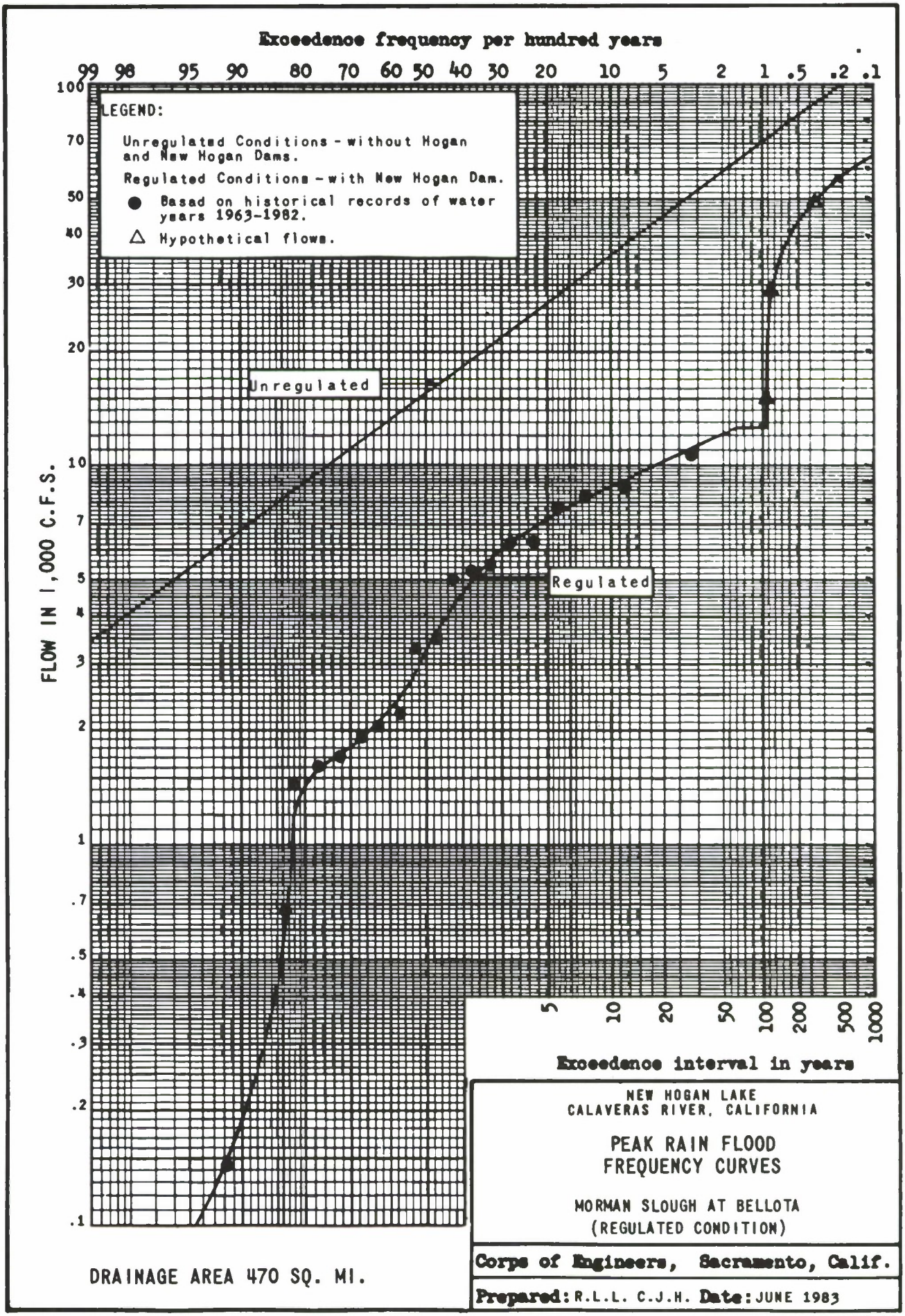
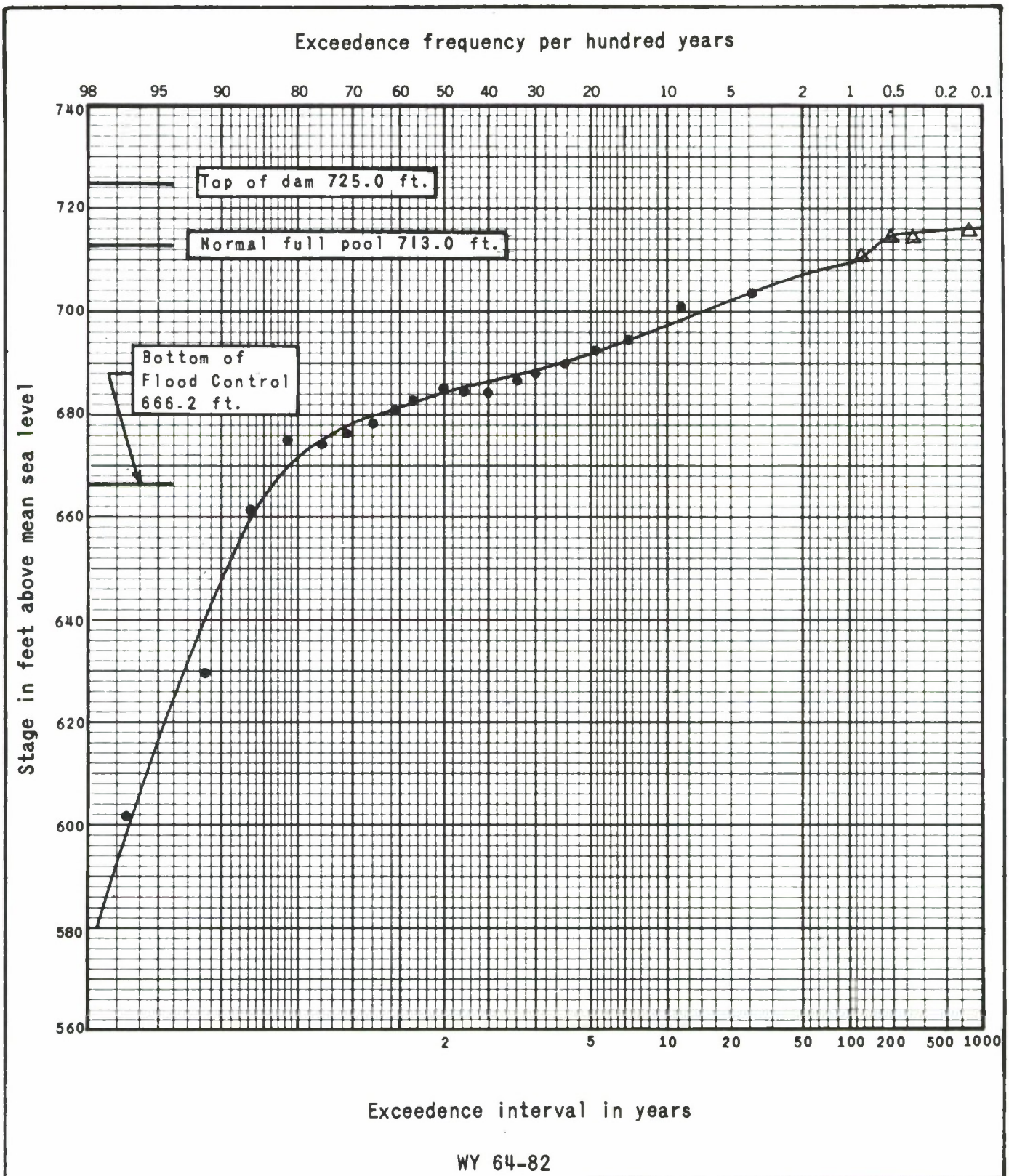

Exceedence frequency per hundred years
99 98 95 90 80 70 60 50 40 30 20 10 5 2 1 .5 .2 .1
LEGEND:
Unregulated Conditions - without Hogan and New Hogan Dams.
Regulated Conditions - with New Hogan Dam.
Basad on historical records of water years 1963-1982.
Hypothetical flows.
Unregulated
Regulated
FLOW IN 1,000 C.F.S.
100 70 50 40 30 20 10 7 5 4 3 2 1 .7 .5 .4 .3 .2 .1
5 10 20 50 100 200 500 1000
Exceedence interval in years
NEW HOGAN LAKE
CALAVERAS RIVER, CALIFORNIA
PEAK RAIN FLOOD
FREQUENCY CURVES
MORMAN SLOUGH AT BELLOTA
(REGULATED CONDITION)
DRAINAGE AREA 470 SQ. MI.
Corps of Engineers, Sacramento, Calif.
Prepared: R.L.L. C.J.H. Date: JUNE 1983

PLATE 22



WY 64-82

LEGEND:

● Historical.

△ Hypothetical.

NEW HOGAN LAKE
CALAVERAS RIVER, CALIFORNIA

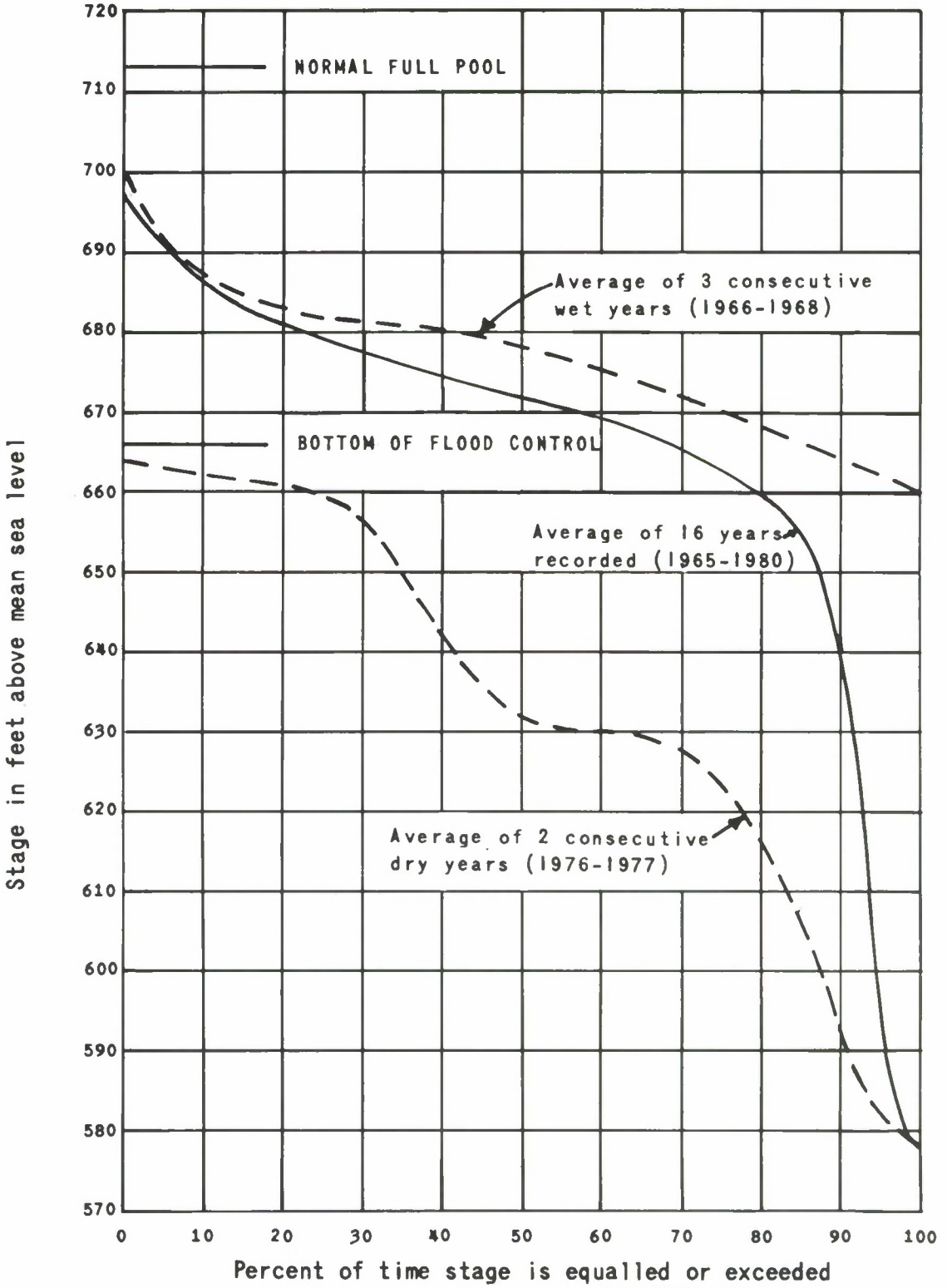
STAGE-FREQUENCY CURVE

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: R.L.L.
Drawn: C.J.

Date: JUNE 1983

PLATE 23



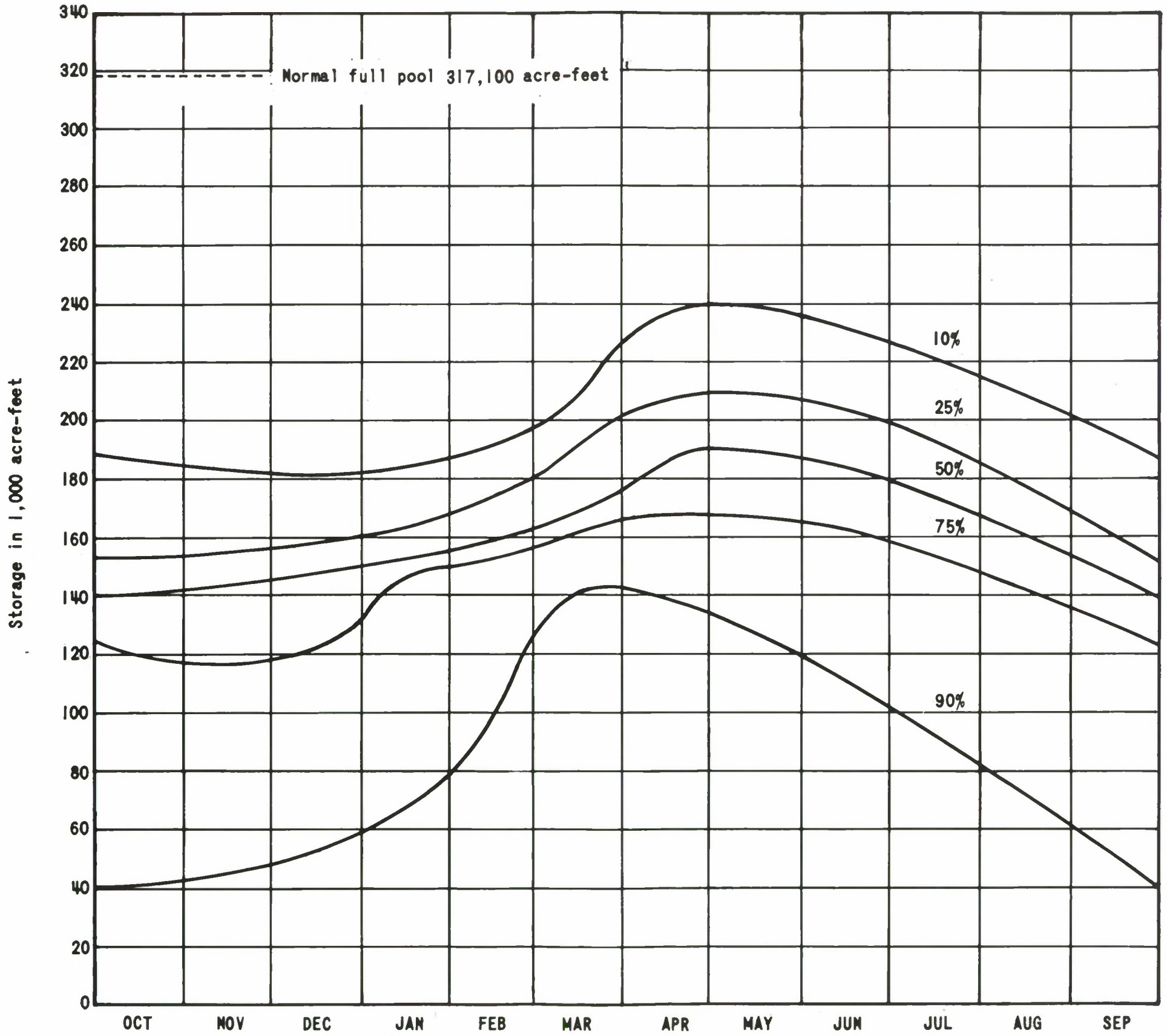
NEW HOGAN LAKE
CALAVERAS RIVER, CALIFORNIA

STAGE-DURATION CURVE

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: T.G.K.
Drawn: C.J.H.
Date: JUNE 1983

PLATE 24



NOTES:

1. Curve parameters indicate exceedence probability.
2. Curves are based on project operations during water years 1965-1980.

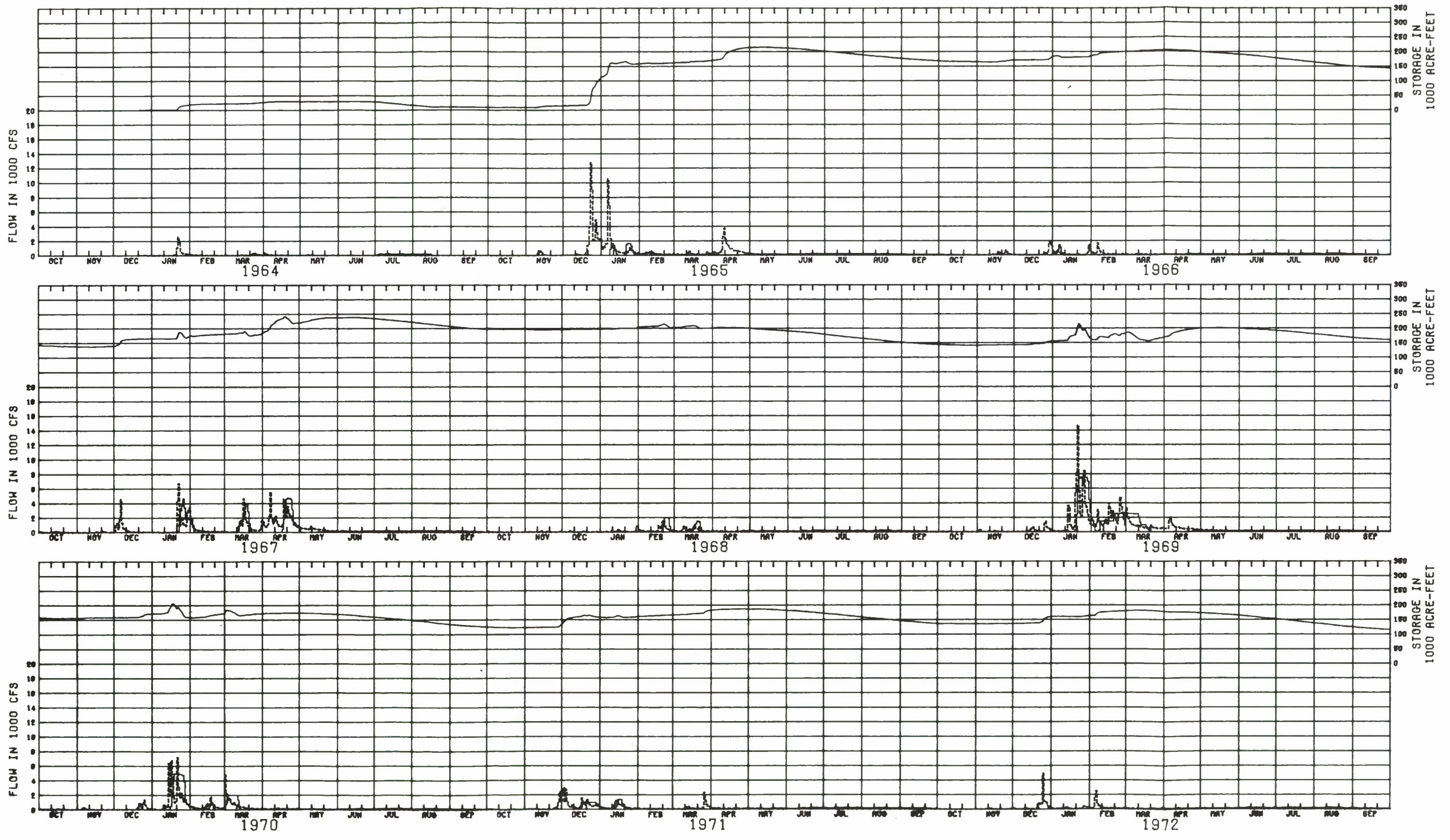
NEW HOGAN LAKE
CALAVERAS RIVER, CALIFORNIA

SEASONAL VARIATION
OF
STORAGE FREQUENCY

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: D.J.H., T.G.K.
Drawn: C.J.H. Date: JUNE 1983

PLATE 25

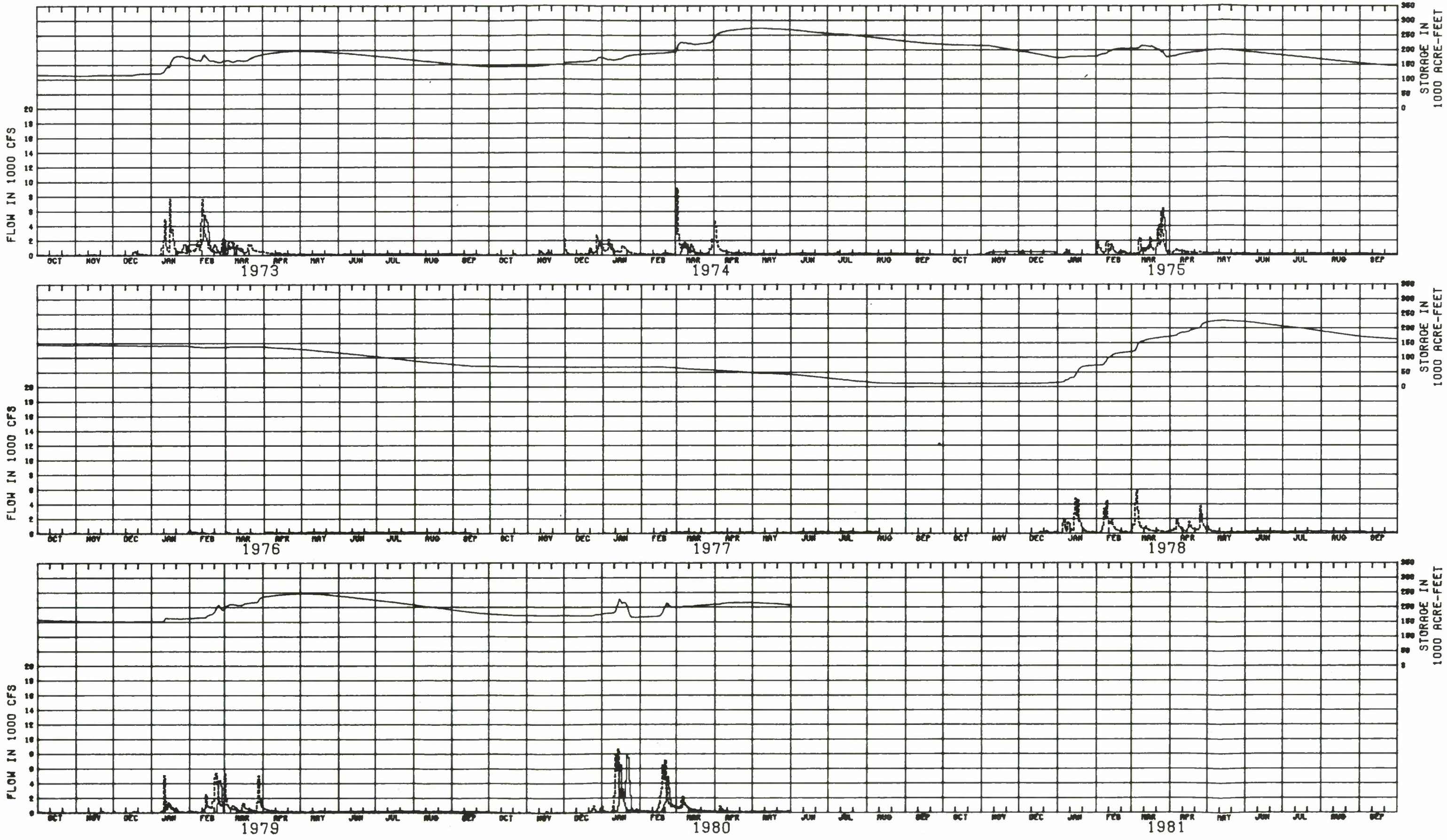


NEW HOGAN LAKE
CALAVERAS RIVER, CALIFORNIA

HISTORICAL OPERATION
NEW HOGAN LAKE

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: D.J.H.,T.G.K. Date: JUNE 1983
Drawn: CAL-COMP



NEW HOGAN LAKE
CALAVERAS RIVER, CALIFORNIA

HISTORICAL OPERATION
NEW HOGAN LAKE

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: D.J.H.,T.G.K. Date: JUNE 1983
Drawn: CAL-COMP

NEW HOGAN DAM AND LAKE
CALAVERAS RIVER, CALIFORNIA

WATER CONTROL MANUAL

JULY 1983

EXHIBIT A

STANDING INSTRUCTIONS TO DAMTENDERS
AND
FLOOD CONTROL REGULATIONS
NEW HOGAN DAM AND LAKE

Department of the Army
Sacramento District, Corps of Engineers
Sacramento, California

PERSONNEL CONCERNED IN THE OPERATION OF NEW HOGAN RESERVOIR

	UNIT	OFFICE PHONE	NAME	HOME PHONE
PROJECT OFFICE VALLEY SPRINGS, CALIFORNIA	NEW HOGAN RESERVOIR	209-772-1343 (VALLEY SPRINGS)	R. L. HOLTZ PARK MANAGER	209-772-2237 (VALLEY SPRINGS)
DEPARTMENT OF THE ARMY SACRAMENTO DISTRICT CORPS OF ENGINEERS SACRAMENTO, CALIFORNIA	DISTRICT ENGINEER	916-440-2232*	COL. A. E. WILLIAMS DISTRICT ENGINEER	
	RESERVOIR CONTROL SECTION	916-440-3405* 916-440-3167* 916-440-3168*	R. A. NEAL CHIEF	916-791-0478 (ROSEVILLE)
		916-440-3475*	R. L. LUNDEEN	916-483-0388
	HYDROLOGIC FACILITIES	916-440-2112*	J. T. JOHNSON	916-685-6135
	OPERATIONS BRANCH	916-440-2327*	M. L. HELM CHIEF	916-961-1918
		916-440-2305*	A. E. SMITH, JR. CHIEF, OPERATIONS & MAINTENANCE SECTION	916-652-5280
U.S. BUREAU OF RECLAMATION SACRAMENTO, CALIFORNIA	MID-PACIFIC REGION	916-484-4571	J. GRAHAM REGIONAL DIRECTOR	
	CENTRAL VALLEY PROJECT OPERATIONS	916-484-4213	D. TUCKER CHIEF, CENTRAL VALLEY OPERATIONS COORDINATING OFFICE	916-967-8793
		916-484-4585	B. LINK CHIEF, WATER OPERATIONS BRANCH	916-481-7911
	CENTRAL VALLEY OPERATIONS COORDINATING OFFICE (NIGHTS AND HOLIDAYS)	916-484-4672 (SACRAMENTO)	POWER SYSTEM DISPATCHERS	
IRRIGATION INTERESTS	STOCKTON EAST WATER DISTRICT P.O. BOX 5157 STOCKTON, CALIFORNIA 95205	209-948-0333 (STOCKTON)	J. D. BEARD II GENERAL MANAGER	209-957-6549 (STOCKTON)
			E. REMINGTON WATERMASTER	209-887-3110 (LINDEN)
	WATER TREATMENT PLANT	209-948-0537 (24 HR)	OPERATOR ON DUTY	

FTS: SACRAMENTO 448-2000; STOCKTON 467-8011
NOTE: BETWEEN 4:30 PM AND 7:45 AM, OR ON SATURDAY, SUNDAY OR HOLIDAYS USE 916-452-1535 (FLOOD SEASON ONLY)

NEW HOGAN RESERVOIR, CALAVERAS RIVER, CALIFORNIA REV. 15-JUNE-83

EXHIBIT A

STANDING OPERATING INSTRUCTIONS TO DAMTENDERS FOR NEW HOGAN DAM AND LAKE CALAVERAS RIVER, CALIFORNIA

CONTENTS

Personnel Concerned in Flood Control Operation of New Hogan Dam and Lake

CHARTS

NEW HOGAN LAKE
CALAVERAS RIVER, CALIFORNIA

WATER CONTROL MANUAL

STANDING OPERATING INSTRUCTIONS TO DAMTENDERS

1. GENERAL

This exhibit to "New Hogan Lake, Calaveras River, California Water Control Manual" was prepared in accordance with instruction EM 1110-2-3600, paragraph 4-07 (Standing Instructions to Damtenders), and pertains to duties and responsibilities of the damtender in operating New Hogan Dam and reporting hydrologic data.

Operational instructions to the damtender are briefly outlined with specific emphasis on the damtender's duties and responsibilities during flood emergencies when communication between him and the operating office may have been disrupted. It is designed to be used independently as an emergency guide or, as published, in conjunction with the water control manual. To facilitate independent use of this exhibit, charts required for emergency flood control operation of New Hogan Lake are included.

2. FLOOD CONTROL OPERATION REQUIREMENTS

New Hogan Lake will be operated for flood control according to the Flood Control Diagram (Chart A-10), which defines the requirements for flood control operation of New Hogan Dam and the Emergency Spillway Release Diagram (Chart A-9), which specifies operation of spillway gates during large floods. The flood control objective for New Hogan Dam and Lake is to minimize flood damage downstream from the dam and, insofar as practicable, to avoid causing damage that would not have occurred without the project.

Storage space in New Hogan Lake shall be reserved on the basis of the Flood Control Diagram, Chart A-10. Whenever encroachment into the flood control storage reservation occur, water should be released as rapidly as possible without causing flows in the Calaveras River at the gaging station at Bellota to exceed the controlling rates shown in the schedule of releases on the flood control diagram and outlined in paragraph 4.

Required flood control storage reservation is determined from Chart A-10, which indicates the storage reservation required at any time from 30 September to 9 June. The diagram requires:

a. Flood control space increases from zero on 30 September to a maximum of 165,000 acre-feet on 30 November and is required until 31 December.

b. After 31 December, the required flood control space varies according to rain flood potential based on antecedent precipitation. In any event, the last day of flood control storage requirements is 8 June. Space not required for flood control may be filled for conservation purposes to allow more efficient operation of the project.

The flood control operation each day consists of determining the required flood control reservation and scheduling releases to provide the required space by the end of the day, whenever possible.

3. LIMITATIONS ON STORAGE

Operational limitations of storage in New Hogan Lake are specified in paragraph 2 of this Exhibit and on the Flood Control Diagram, Chart A-10. There are no legal limitations on storage, as most of the project boundary is above the maximum operating level, and flowage and storage easements cover the rest.

Physical limitations on storage are as follows:

STORAGE 1/ ACRE-FEET	WATER SURFACE 1/ ELEVATION (FEET)	FLOW OVER SPILLWAY (CFS)	REMARKS
14,900	586.0	0	Inactive pool
317,100	713.0	0	Normal full pool
348,600	720.0	118,000	Spillway design flood pool

Notes:
1/ Based on 1978 storage-elevation, storage rounded.

4. LIMITATIONS ON RELEASES

Except during emergency spillway operation described below, releases from New Hogan Lake will be limited insofar as possible to 12,500 cubic feet per second. A stage-discharge curve for the Mormon Slough at Bellota is shown on Chart A-6.

Releases from New Hogan shall not change more than 2,000 cubic feet per second per 2-hour period to permit orderly evacuation of personnel, property, livestock, etc., in advance of rising water downstream and to minimize bank caving as the flow recedes after extended periods of bankful flows. Outlet rating curves are shown on Chart A-3.

Whenever the lake level rises above elevation 679.5 feet, the damtender shall refer to the Emergency Spillway Release Diagram, Chart A-9, for possible emergency releases. When the diagram indicates emergency releases should be initiated, it is essential that these releases be made immediately, since the diagram indicates the minimum releases that could be made during very large floods without endangering the structure, without causing peak outflows to exceed peak inflow, and without requiring excessively rapid changes in outflow. If the minimum required release is less than the normal outlet capacity, the releases shall be made through the outlet works. Whenever a release greater than the outlet capacity is required, the additional release shall be made through operation of spillway gates. If the outlet works become inoperable at anytime, the entire required release shall be made through the spillway gates. In all cases, Chart A-9 governs the release.

5. STANDING INSTRUCTIONS DURING FLOOD EMERGENCY

The functional operation of New Hogan Dam and Lake is under the direction of the Reservoir Control Section, Corps of Engineers, Sacramento District. Detailed operation instructions for flood control will be issued from the Reservoir Control Section in Sacramento. During flood periods close contact will be maintained between operating personnel at New Hogan and the Reservoir Control Section in Sacramento. The following are suggested instructions for emergency operation of New Hogan Dam if communication between operating personnel and the Reservoir Control Section is broken during a flood emergency.

a. Continue release in accordance with the last instructions from the Reservoir Control Section, and make every attempt to reestablish communication.

b. If communication cannot be reestablished, make releases in accordance with the Flood Control Diagram, Chart A-10 and the Emergency Spillway Release Diagram, Chart A-9.

6. OPERATIONAL RESPONSIBILITIES

Responsibilities for flood control operation of New Hogan Dam are summarized below. A table of personnel involved in the operation of the reservoir for flood control are contained at the front of the exhibit.

a. The District Engineer, Sacramento District, Corps of Engineers, is responsible for:

(1) Approving or disapproving deviations from the prescribed flood control criteria on Chart A-10.

(2) Advising concerned agencies and the Chief of Engineers of any departure from the flood control regulations.

(3) Preparing monthly operation and other special reports relative to operation of the reservoir required by the Office, Chief of Engineers.

(4) Preparing revisions to the flood control criterion found herein.

b. The New Hogan Park Manager is responsible for:

(1) Accomplishing the physical operation of the reservoir and associated facilities in accordance with the official regulations.

(2) Advising the District Engineer, Sacramento District, Corps of Engineers, of any deviation from the flood control operation.

(3) Reporting to the District Engineer, Sacramento District, Corps of Engineers, any unusual condition in the reservoir or along downstream channels that might interfere with planned flood control operation of reservoir.

(4) Keeping downstream interests advised of all changes of flood control releases which might affect them.

(5) Reporting by telephone to the Reservoir Control Section, Sacramento District Corps of Engineers, data as outlined in paragraph 7a and other data that may be required from time to time.

(6) Keeping informed of the rules and regulations contained in the water control manual and bringing to the attention of the District Engineer, Sacramento District, Corps of Engineers any features of the manual that may require clarification or revision.

(7) Keeping the District Engineer, Sacramento District, Corps of Engineers advised of any inaccuracies contained in the manual or that may develop as a consequence of changing conditions.

(8) Immediately after the end of each month, transmitting to the Reservoir Control Section, Sacramento District, Corps of Engineers data specified in paragraph 7b.

7. OPERATION REPORTS

a. Between 7:45 and 9 a.m. each workday, and at other times upon request, the dam operator or operating agency will report by radio or telephone to the Reservoir Control Section, Sacramento District, Corps of Engineers, the following information:

a. Reservoir stage and storage as of midnight.

b. Gate settings during the previous 24 hours.

c. Mean daily flows, ending midnight, of:

(1) The Calaveras River below New Hogan Dam,

(2) Total inflow to New Hogan Lake.

d. Flow of Mormon Slough at Bellota.

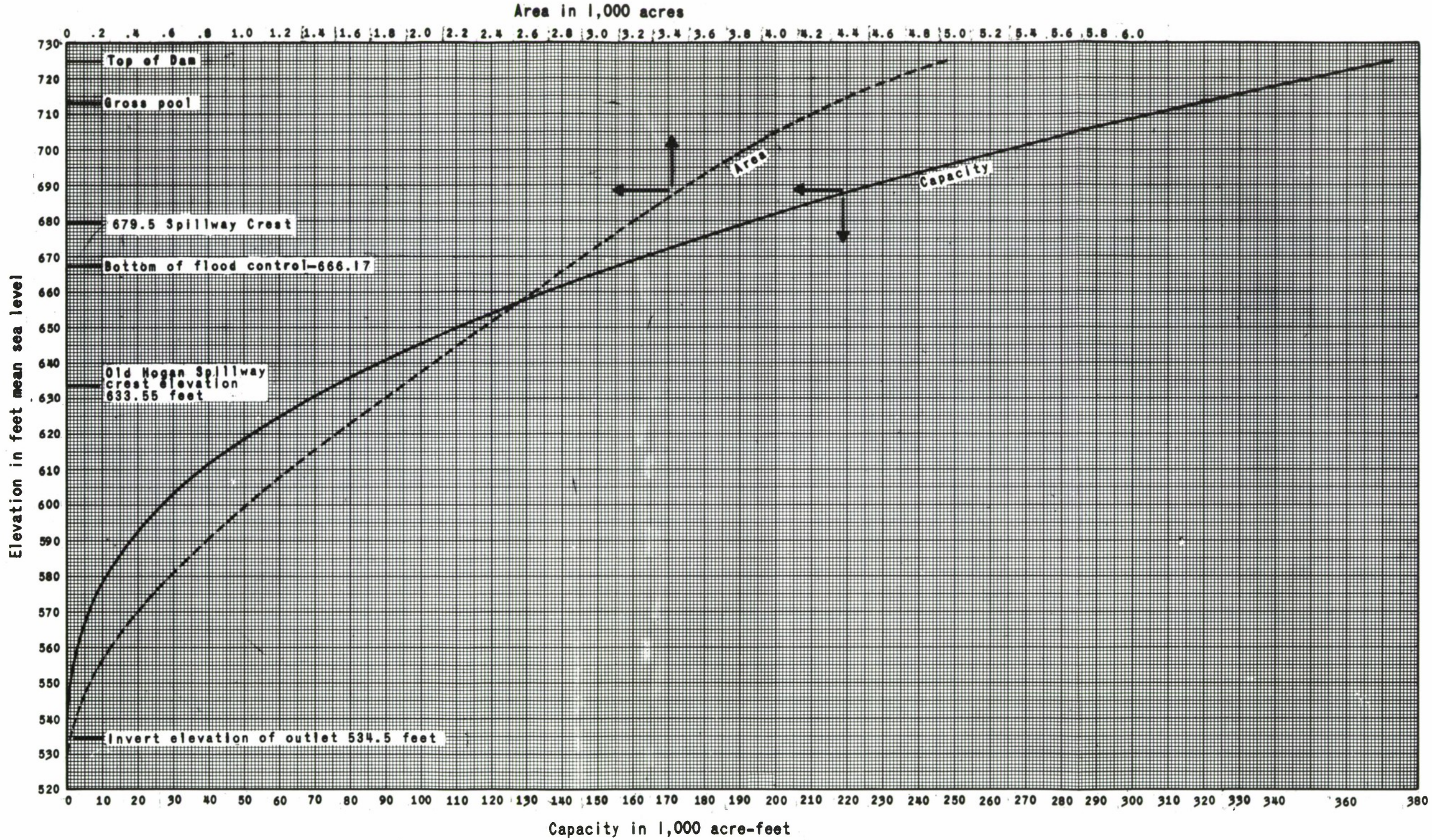
e. Meteorological data at the dam.

f. Reports from radio-reporting precipitation stations.

When conditions do not warrant holiday or weekend reports, the complete report for each day shall be made on the first working day following the nonreporting period. More frequent reports of the above information and reports of other Calaveras River data will be made in the same manner when requested by the Reservoir Regulation Section.

8. MODIFICATIONS OF REGULATIONS

The official regulations are subject to temporary modification during flood emergencies by the District Engineer, Sacramento District, Corps of Engineers. The flood control criteria will be revised by the Corps of Engineers, as necessary, to reflect changed conditions that come to bear upon flood control operation of the reservoir. Permanent revisions of the flood control criteria are subject to prior approval of the Chief of Engineers or his duly authorized respresentative.



NEW HOGAN LAKE
CALAVERAS RIVER, CALIFORNIA

NEW HOGAN LAKE
AREA AND CAPACITY CURVES

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: T.G.K.
Drawn: T.G.K.
Date: JUNE 1965

CHART A-1

NEW HOGAN LAKE
AREA AND CAPACITY TABLE

CAPACITIES OF NEW HOGAN LAKE - CALAVERAS RIVER, CALIFORNIA

ELEVATION FEET	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	DIFFERENCE
					ACRE-FEET						
530.0	8	9	9	10	11	11	12	13	14	15	8
531.0	16	16	17	18	19	20	21	23	24	25	10
532.0	26	27	29	30	31	33	34	35	37	38	14
533.0	40	42	43	45	47	48	50	52	54	56	17
534.0	57	59	61	63	66	68	70	72	74	77	22
535.0	79	81	84	86	89	91	94	96	99	102	26
536.0	105	107	110	113	116	119	122	125	129	132	30
537.0	135	138	142	145	149	152	156	159	163	167	35
538.0	170	174	178	182	186	190	194	198	202	207	41
539.0	211	215	220	224	229	234	238	243	248	253	46
540.0	257	262	267	273	278	283	288	294	299	304	53
541.0	310	316	321	327	333	339	344	350	357	363	59
542.0	369	375	381	388	394	401	407	414	421	428	66
543.0	435	441	449	456	463	470	477	485	492	500	72
544.0	507	515	523	531	539	547	555	563	571	580	81
545.0	588	596	605	614	622	631	640	649	658	667	88
546.0	676	686	695	704	714	724	733	743	753	763	97
547.0	773	783	793	804	814	825	835	846	857	868	106
548.0	879	890	901	912	923	935	946	958	969	981	114
549.0	993	1005	1017	1029	1041	1054	1066	1079	1091	1104	124
550.0	1117	1130	1143	1156	1169	1183	1196	1210	1223	1237	134
551.0	1251	1265	1279	1293	1307	1322	1336	1351	1365	1380	144
552.0	1395	1410	1425	1440	1455	1471	1486	1502	1518	1534	155
553.0	1550	1566	1582	1598	1614	1631	1648	1664	1681	1698	165
554.0	1715	1732	1750	1767	1785	1802	1820	1838	1856	1874	177
555.0	1892	1910	1929	1947	1966	1985	2004	2023	2042	2061	189
556.0	2081	2100	2120	2140	2159	2180	2200	2220	2240	2261	200
557.0	2281	2302	2323	2344	2365	2386	2408	2429	2451	2473	214
558.0	2495	2517	2539	2561	2583	2606	2629	2651	2674	2697	225
559.0	2720	2744	2767	2791	2814	2838	2862	2886	2911	2935	240
560.0	2960	2984	3009	3034	3059	3084	3109	3135	3160	3186	252
561.0	3212	3238	3264	3291	3317	3344	3370	3397	3424	3451	267
562.0	3479	3506	3534	3561	3589	3617	3645	3673	3702	3730	280
563.0	3759	3788	3817	3846	3875	3905	3934	3964	3994	4024	295
564.0	4054	4085	4115	4146	4176	4207	4238	4270	4301	4333	310
565.0	4364	4396	4428	4460	4493	4525	4558	4590	4623	4656	326
566.0	4690	4723	4756	4790	4824	4858	4892	4926	4961	4995	340
567.0	5030	5065	5100	5135	5171	5207	5242	5278	5314	5350	357
568.0	5387	5423	5460	5497	5534	5571	5608	5646	5684	5722	373
569.0	5760	5798	5836	5875	5913	5952	5991	6030	6070	6109	389
570.0	6149	6189	6229	6269	6309	6350	6390	6431	6472	6513	406
571.0	6555	6596	6638	6680	6722	6764	6807	6849	6892	6935	423
572.0	6978	7021	7065	7108	7152	7196	7240	7284	7329	7374	441
573.0	7419	7463	7509	7554	7600	7645	7691	7737	7784	7830	458
574.0	7877	7923	7970	8018	8065	8113	8160	8208	8256	8304	476
575.0	8353	8401	8450	8499	8548	8598	8647	8697	8747	8797	494

NEW HOGAN LAKE
AREA AND CAPACITY TABLE

CAPACITIES OF NEW HOGAN LAKE - CALAVERAS RIVER, CALIFORNIA

(CONTINUED)

ELEVATION FEET	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	DIFFERENCE
	ACRE-FEET										
576.0	8847	8898	8948	8999	9050	9101	9153	9204	9256	9308	513
577.0	9360	9413	9465	9518	9571	9624	9677	9731	9784	9838	532
578.0	9892	9946	10001	10055	10110	10165	10220	10276	10331	10387	551
579.0	10443	10499	10555	10612	10669	10726	10783	10840	10898	10955	570
580.0	11013	11071	11130	11188	11247	11306	11365	11424	11483	11543	590
581.0	11603	11663	11723	11784	11845	11906	11966	12028	12089	12151	610
582.0	12213	12275	12337	12400	12462	12525	12588	12652	12715	12779	630
583.0	12843	12907	12971	13036	13100	13165	13230	13296	13361	13427	650
584.0	13493	13559	13625	13692	13759	13826	13893	13960	14028	14096	671
585.0	14164	14232	14300	14369	14438	14507	14576	14646	14715	14785	691
586.0	14855	14926	14996	15067	15138	15209	15281	15352	15424	15496	713
587.0	15568	15641	15713	15786	15859	15933	16006	16080	16154	16228	734
588.0	16302	16377	16452	16527	16602	16677	16753	16829	16905	16981	756
589.0	17058	17135	17212	17289	17366	17444	17522	17600	17678	17757	777
590.0	17835	17914	17993	18073	18152	18232	18312	18393	18473	18554	800
591.0	18635	18716	18797	18879	18961	19043	19125	19207	19290	19373	821
592.0	19456	19539	19623	19707	19791	19875	19960	20045	20129	20215	844
593.0	20300	20386	20472	20558	20644	20731	20817	20904	20991	21079	867
594.0	21167	21254	21343	21431	21519	21608	21697	21787	21876	21966	889
595.0	22056	22146	22236	22327	22418	22509	22600	22692	22784	22876	912
596.0	22968	23061	23153	23246	23339	23433	23526	23620	23714	23809	936
597.0	23904	23998	24093	24189	24284	24380	24476	24572	24669	24765	958
598.0	24862	24959	25057	25154	25252	25351	25449	25547	25646	25745	983
599.0	25845	25944	26044	26144	26244	26345	26445	26546	26647	26749	1006
600.0	26851	26953	27055	27157	27260	27363	27466	27569	27673	27776	1030
601.0	27881	27985	28089	28194	28299	28405	28510	28616	28722	28828	1054
602.0	28935	29041	29148	29255	29363	29471	29579	29687	29795	29904	1078
603.0	30013	30122	30231	30341	30451	30561	30671	30782	30893	31004	1103
604.0	31116	31227	31339	31451	31563	31676	31789	31902	32015	32129	1127
605.0	32243	32357	32471	32585	32700	32816	32931	33046	33162	33278	1152
606.0	33395	33511	33628	33745	33862	33980	34097	34216	34334	34452	1176
607.0	34571	34690	34810	34929	35049	35169	35289	35410	35530	35652	1202
608.0	35773	35894	36016	36138	36261	36383	36506	36629	36752	36876	1227
609.0	37000	37124	37248	37373	37498	37623	37748	37874	37999	38126	1252
610.0	38252	38378	38505	38632	38760	38888	39015	39144	39272	39401	1278
611.0	39530	39659	39788	39918	40048	40178	40308	40439	40570	40701	1303
612.0	40833	40964	41096	41229	41361	41494	41627	41760	41894	42028	1329
613.0	42162	42296	42431	42565	42700	42836	42971	43107	43243	43380	1354
614.0	43516	43653	43790	43928	44065	44203	44341	44480	44619	44758	1381
615.0	44897	45036	45176	45316	45456	45597	45738	45879	46020	46162	1407
616.0	46304	46446	46588	46731	46874	47017	47160	47304	47448	47592	1433
617.0	47737	47881	48026	48171	48317	48463	48609	48755	48902	49049	1459
618.0	49196	49343	49491	49638	49787	49935	50084	50233	50382	50532	1485
619.0	50681	50831	50982	51132	51283	51434	51585	51737	51889	52041	1513
620.0	52194	52346	52499	52652	52806	52960	53113	53268	53422	53577	1538
621.0	53732	53887	54043	54199	54355	54512	54668	54825	54982	55140	1566
622.0	55298	55456	55614	55772	55931	56091	56250	56410	56569	56730	1592
623.0	56890	57051	57212	57373	57534	57696	57858	58021	58183	58346	1619
624.0	58509	58673	58836	59000	59165	59329	59494	59659	59824	59990	1647
625.0	60156	60322	60488	60655	60822	60989	61156	61324	61492	61660	1673

NEW HOGAN LAKE
AREA AND CAPACITY TABLE

CAPACITIES OF NEW HOGAN LAKE - CALAVERAS RIVER, CALIFORNIA

(CONTINUED)

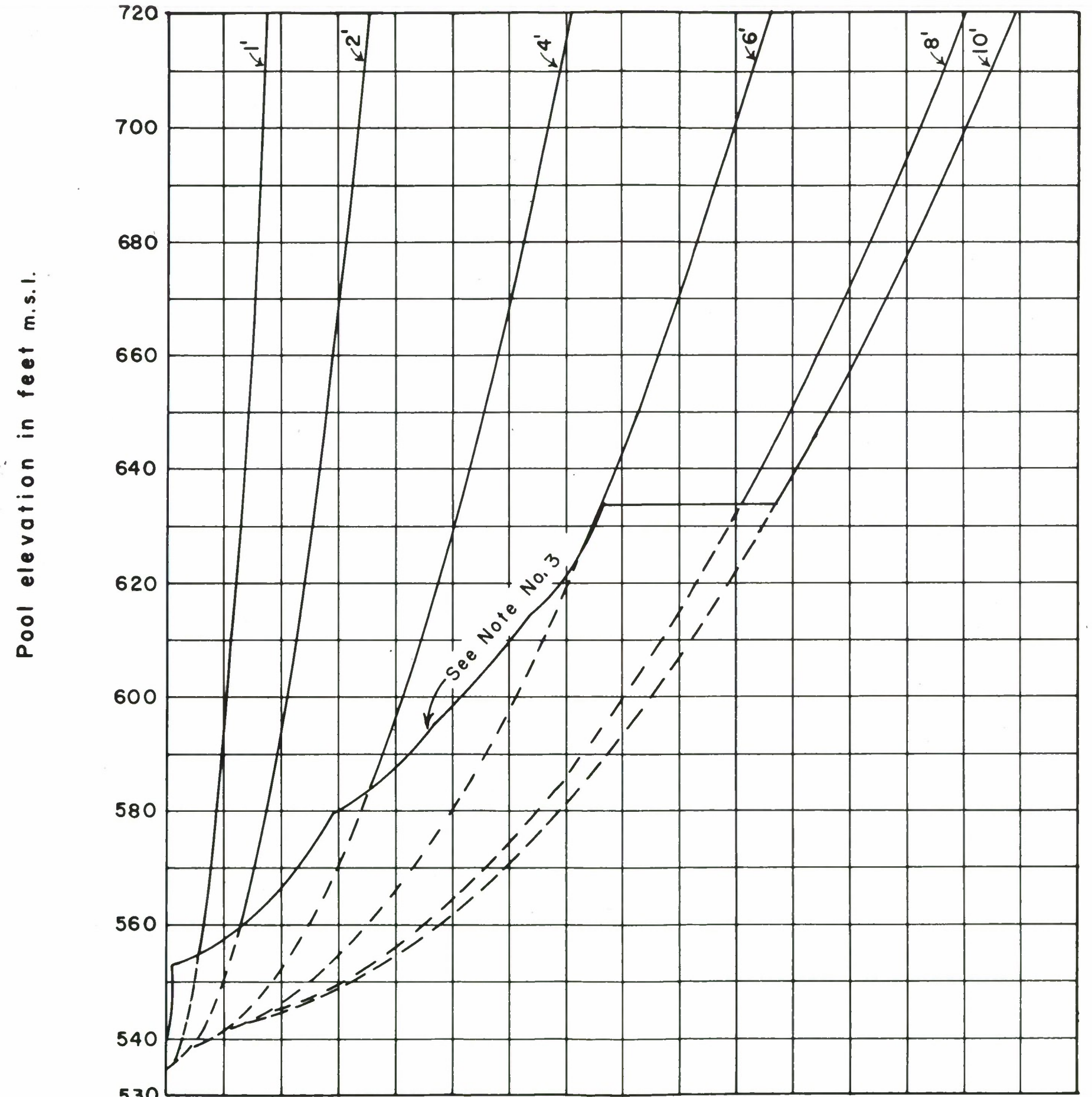
ELEVATION FEET	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	DIFFERENCE
					ACRE-FEET						
626.0	61829	61998	62167	62336	62506	62676	62846	63016	63187	63358	1701
627.0	63530	63701	63873	64045	64217	64390	64563	64736	64909	65083	1727
628.0	65257	65431	65606	65781	65956	66132	66307	66483	66659	66836	1756
629.0	67013	67189	67367	67544	67722	67900	68079	68257	68436	68616	1782
630.0	68795	68975	69155	69335	69516	69697	69878	70059	70241	70423	1810
631.0	70605	70788	70971	71153	71337	71521	71704	71889	72073	72258	1838
632.0	72443	72628	72814	72999	73186	73372	73559	73746	73933	74120	1865
633.0	74308	74496	74685	74873	75062	75251	75441	75631	75820	76011	1893
634.0	76201	76392	76583	76774	76966	77158	77350	77543	77735	77929	1921
635.0	78122	78316	78510	78704	78898	79093	79288	79483	79679	79875	1949
636.0	80071	80267	80464	80661	80858	81056	81253	81451	81650	81848	1976
637.0	82047	82246	82446	82645	82846	83046	83246	83448	83648	83850	2005
638.0	84052	84254	84456	84658	84861	85065	85268	85472	85675	85880	2032
639.0	86084	86289	86494	86699	86905	87111	87317	87524	87730	87937	2061
640.0	88145	88352	88560	88768	88977	89186	89394	89604	89813	90023	2088
641.0	90233	90444	90654	90865	91077	91288	91500	91712	91924	92137	2117
642.0	92350	92563	92777	92990	93204	93419	93633	93848	94063	94279	2145
643.0	94495	94711	94927	95143	95361	95578	95795	96013	96231	96449	2173
644.0	96668	96887	97106	97325	97545	97765	97985	98206	98426	98648	2201
645.0	98869	99091	99313	99535	99757	99981	100203	100427	100650	100874	2230
646.0	101099	101323	101548	101773	101998	102224	102450	102676	102902	103129	2258
647.0	103357	103584	103812	104039	104267	104496	104725	104954	105183	105413	2286
648.0	105643	105873	106103	106334	106565	106796	107028	107260	107492	107724	2314
649.0	107957	108190	108423	108657	108891	109125	109359	109594	109829	110064	2343
650.0	110300	110536	110772	111008	111245	111482	111719	111957	112194	112433	2371
651.0	112671	112910	113149	113388	113628	113868	114107	114348	114588	114830	2400
652.0	115071	115312	115554	115796	116039	116281	116524	116768	117011	117255	2428
653.0	117499	117743	117988	118233	118478	118724	118969	119215	119461	119708	2457
654.0	119956	120202	120450	120698	120946	121194	121443	121692	121941	122190	2484
655.0	122440	122690	122941	123191	123442	123694	123945	124197	124448	124701	2514
656.0	124954	125206	125460	125713	125967	126221	126475	126730	126985	127240	2542
657.0	127496	127751	128007	128263	128520	128777	129034	129292	129549	129807	2570
658.0	130066	130324	130583	130842	131102	131362	131621	131882	132142	132403	2599
659.0	132665	132926	133188	133449	133712	133975	134237	134501	134764	135028	2627
660.0	135292	135556	135821	136085	136351	136616	136882	137148	137414	137681	2656
661.0	137948	138215	138482	138750	139018	139287	139555	139824	140093	140362	2684
662.0	140632	140902	141172	141443	141714	141985	142256	142528	142800	143072	2713
663.0	143345	143617	143891	144164	144438	144712	144986	145261	145535	145811	2741
664.0	146086	146362	146638	146914	147191	147468	147745	148022	148299	148578	2770
665.0	148856	149134	149414	149692	149972	150252	150532	150812	151092	151373	2799
666.0	151655	151936	152218	152499	152782	153065	153347	153630	153913	154197	2827
667.0	154482	154766	155050	155335	155620	155906	156191	156477	156763	157050	2855
668.0	157337	157624	157912	158199	158487	158776	159064	159353	159642	159931	2884
669.0	160221	160511	160802	161092	161383	161674	161965	162257	162549	162841	2913
670.0	163134	163427	163720	164013	164307	164601	164895	165190	165484	165780	2942
671.0	166076	166371	166667	166963	167260	167557	167854	168151	168449	168747	2970
672.0	169046	169344	169643	169942	170241	170541	170841	171142	171442	171743	2998
673.0	172044	172345	172647	172949	173252	173554	173857	174160	174463	174767	3028
674.0	175072	175376	175681	175985	176290	176596	176902	177208	177514	177821	3056
675.0	178128	178435	178742	179050	179358	179667	179975	180284	180593	180903	3085

NEW HOGAN LAKE
AREA AND CAPACITY TABLE

CAPACITIES OF NEW HOGAN LAKE - CALAVERAS RIVER, CALIFORNIA

(CONTINUED)

ELEVATION FEET	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	DIFFERENCE
					ACRE-FEET						
676.0	181213	181523	181833	182143	182455	182766	183077	183389	183701	184014	3114
677.0	184327	184639	184953	185266	185580	185894	186208	186523	186838	187154	3142
678.0	187469	187785	188101	188417	188734	189052	189369	189686	190004	190322	3172
679.0	190641	190959	191279	191598	191918	192238	192558	192878	193199	193520	3201
680.0	193842	194163	194485	194807	195130	195453	195776	196100	196423	196747	3230
681.0	197072	197396	197721	198046	198372	198698	199023	199350	199676	200003	3259
682.0	200331	200658	200986	201314	201642	201971	202300	202630	202959	203289	3288
683.0	203619	203949	204280	204611	204943	205275	205606	205939	206271	206604	3318
684.0	206937	207270	207604	207938	208272	208607	208942	209277	209612	209948	3348
685.0	210285	210620	210957	211294	211631	211969	212307	212645	212983	213322	3377
686.0	213662	214000	214340	214680	215020	215361	215702	216043	216384	216726	3407
687.0	217069	217410	217753	218096	218439	218783	219127	219471	219815	220160	3437
688.0	220506	220850	221196	221542	221888	222235	222582	222929	223276	223624	3467
689.0	223973	224321	224670	225018	225368	225718	226067	226418	226768	227119	3497
690.0	227470	227821	228173	228525	228878	229231	229583	229937	230290	230644	3528
691.0	230998	231352	231708	232062	232418	232774	233130	233486	233843	234200	3560
692.0	234558	234915	235273	235631	235989	236349	236707	237067	237426	237787	3590
693.0	238148	238508	238869	239230	239592	239954	240316	240679	241042	241405	3621
694.0	241769	242133	242497	242861	243226	243592	243957	244323	244689	245055	3653
695.0	245422	245789	246157	246524	246892	247261	247629	247999	248367	248737	3686
696.0	249108	249477	249848	250219	250591	250962	251334	251706	252079	252452	3717
697.0	252825	253198	253573	253946	254321	254696	255071	255447	255822	256199	3751
698.0	256576	256952	257330	257707	258085	258463	258841	259221	259599	259979	3783
699.0	260359	260739	261120	261500	261882	262264	262645	263028	263410	263793	3818
700.0	264177	264560	264944	265328	265713	266098	266483	266869	267254	267641	3851
701.0	268028	268414	268802	269189	269578	269966	270355	270744	271133	271523	3886
702.0	271914	272304	272695	273085	273477	273870	274261	274654	275047	275441	3921
703.0	275835	276228	276623	277017	277413	277808	278204	278600	278996	279394	3956
704.0	279791	280188	280587	280985	281384	281783	282182	282582	282982	283383	3993
705.0	283784	284185	284587	284989	285391	285795	286197	286601	287004	287409	4030
706.0	287814	288219	288624	289030	289436	289843	290250	290657	291064	291473	4068
707.0	291882	292290	292700	293109	293519	293930	294340	294752	295163	295575	4106
708.0	295988	296400	296813	297226	297641	298055	298470	298885	299300	299716	4145
709.0	300133	300549	300967	301384	301802	302221	302639	303058	303477	303898	4185
710.0	304318	304738	305160	305581	306003	306426	306848	307272	307695	308120	4226
711.0	308544	308969	309394	309820	310246	310673	311100	311527	311955	312383	4269
712.0	312813	313241	313671	314100	314531	314963	315393	315825	316257	316690	4310
713.0	317123	317556	317991	318424	318860	319295	319730	320167	320603	321040	4355
714.0	321478	321916	322354	322793	323232	323673	324112	324553	324994	325436	4400
715.0	325878	326320	326764	327206	327651	328096	328540	328985	329431	329877	4446
716.0	330324	330771	331219	331667	332116	332565	333014	333465	333915	334366	4494
717.0	334818	335269	335722	336175	336629	337083	337537	337992	338447	338904	4543
718.0	339361	339817	340275	340732	341191	341651	342109	342570	343030	343491	4592
719.0	343953	344415	344878	345340	345804	346269	346733	347198	347664	348130	4645
720.0	348598	349064	349533	350000	350470	350940	351409	351880	352350	352822	4697
721.0	353295	353767	354241	354714	355189	355664	356139	356616	357092	357569	4752
722.0	358047	358525	359004	359483	359964	360445	360925	361407	361889	362372	4809
723.0	362856	363340	363825	364309	364796	365282	365769	366257	366744	367234	4867
724.0	367723	368213	368704	369194	369687	370180	370672	371166	371660	372155	4928



NOTES:

1. Parameter is average gate opening in feet of all 4 gates.

2. To obtain gate opening for any discharge at the existing pool elevation plot gate openings against discharge and read gate opening required.

3. Maximum outflow limited by Old Hogan outlet capacity when pool is below Old Hogan crest.

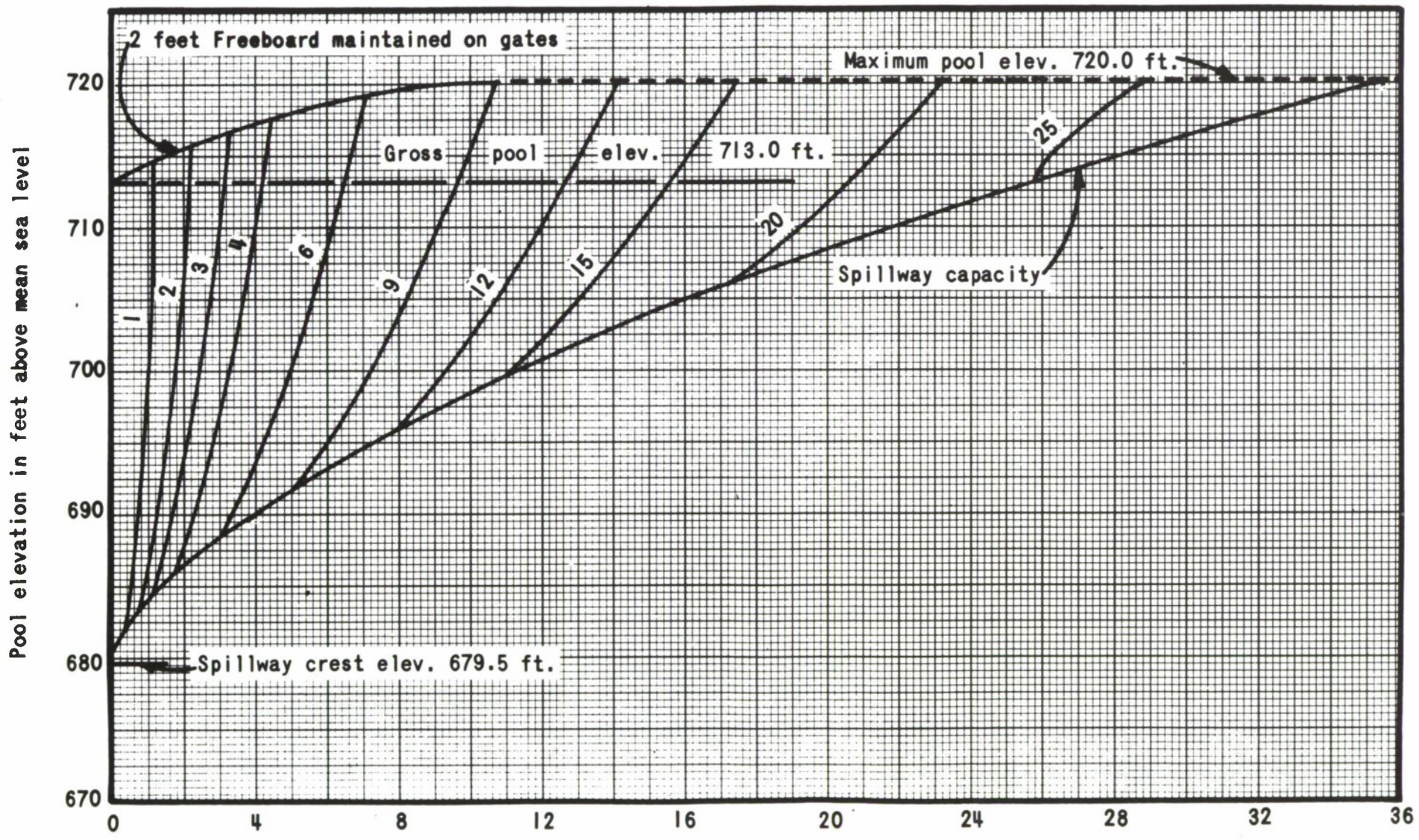
NEW HOGAN LAKE
CALAVERAS RIVER, CALIFORNIA

OUTLET WORKS
PARTIAL GATE OPENING
DISCHARGE CURVES

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: T.G.K. Drawn: C.J.H. Date: JUNE 1983

CHART A-3



NOTES:

1. Ratings are for one of three Tainter gates with adjacent gates operating.
2. Parameter is gate opening in feet.
3. Gate seat elevation is 678.48 feet.
4. At such time as the water flow free (below bottom of spillway gate) discharge is indicated by "uncontrolled discharge" curve regardless of gate opening. Therefore, unless precautionary measures are taken, flow may suddenly increase as water surface falls within 2 feet of uncontrolled discharge curve.

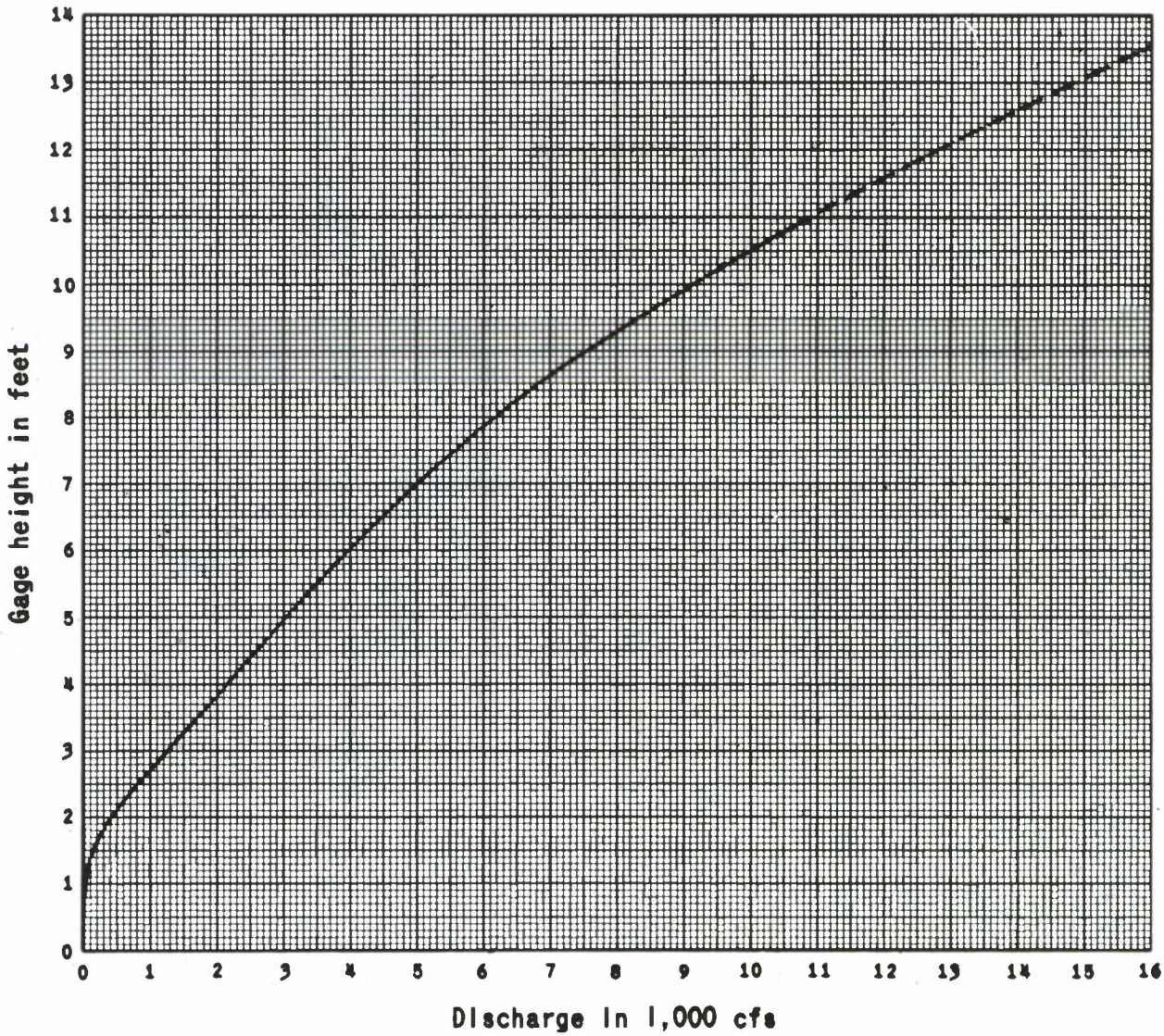
NEW HOGAN LAKE
CALAVERAS RIVER, CALIFORNIA

SPILLWAY RATING CURVE
(FOR ONE 38' GATE)

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: T.G.K. Date: JUNE 1963
Drawn: C.J.H.

CHART A-4



NOTES:

1. Discharge estimated above gage height of 11.00 feet.
2. Zero flow = 519.93 ft. msl at gage height .13 feet.

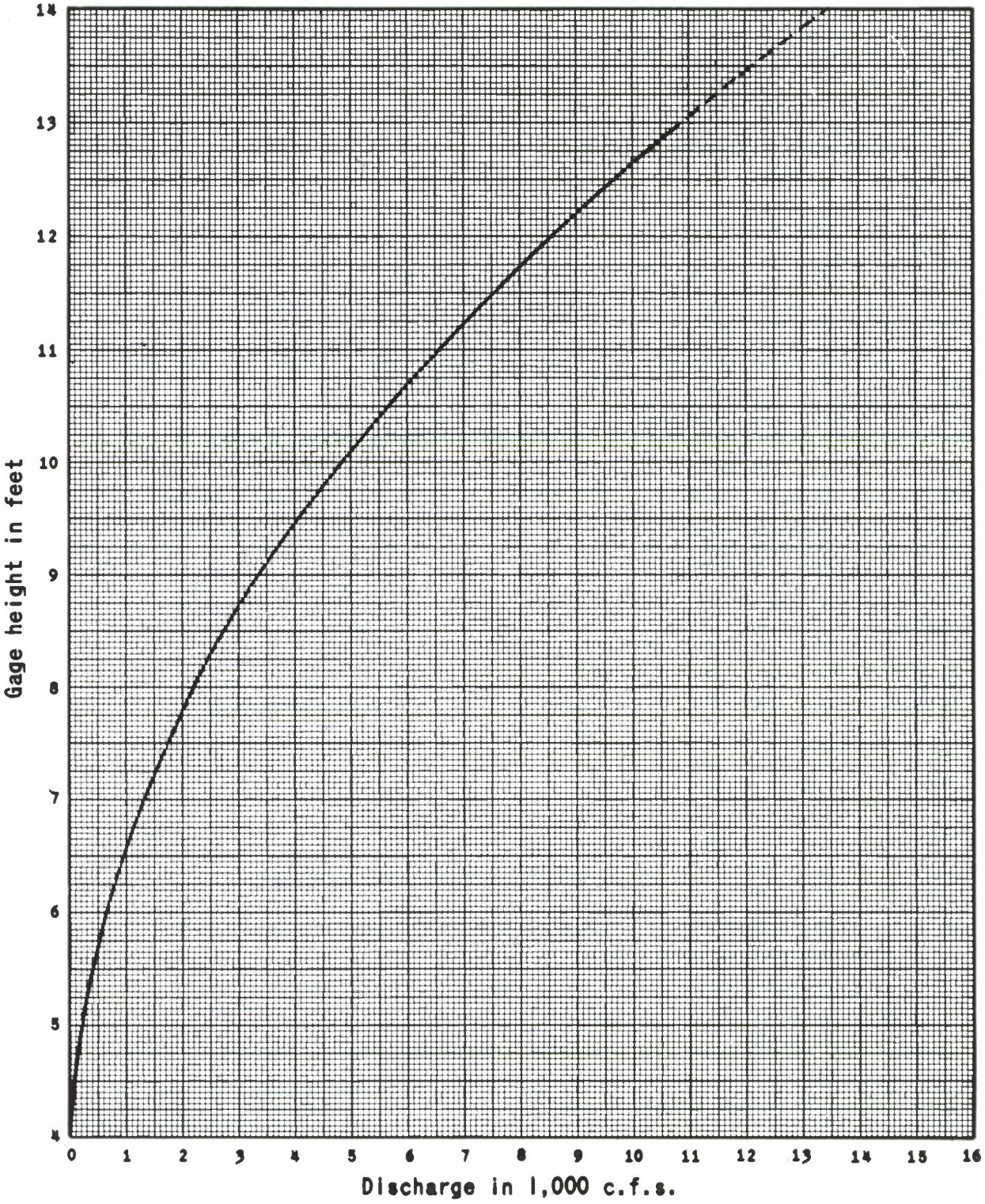
NEW HOGAN LAKE
CALAVERAS RIVER, CALIFORNIA

DISCHARGE RATING CURVE

CALAVERAS RIVER BELOW
NEW HOGAN DAM NEAR
VALLEY SPRINGS

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: T.G.K.
Drawn: T.G.K.
Date: JUNE 1983



NOTES:

1. Discharge estimated above gage height of 12.99 feet.
2. Zero flow = 3.96 feet gage height.

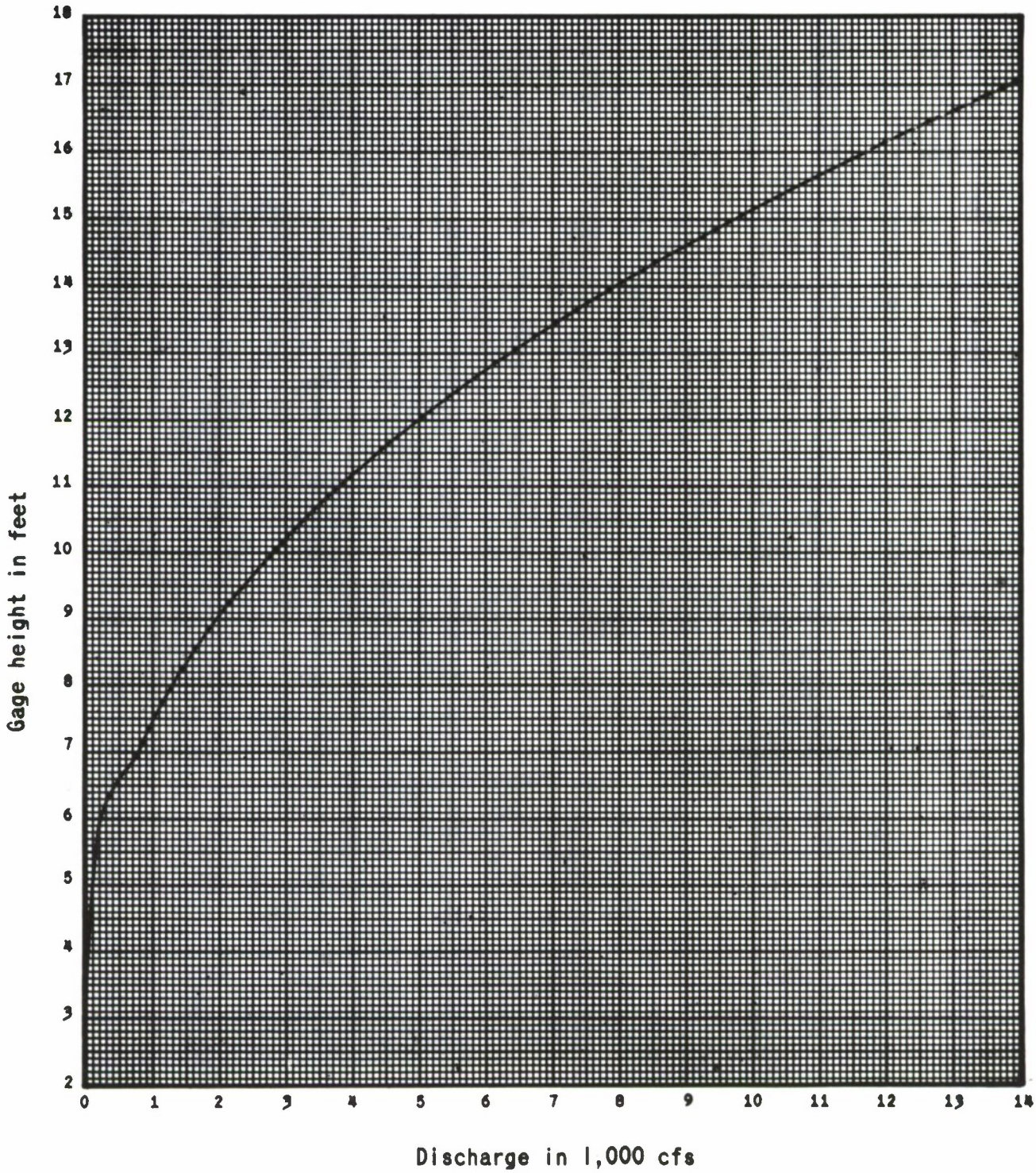
NEW HOGAN LAKE
CALAVERAS RIVER, CALIFORNIA

DISHARGE RATING CURVE

MORMON SLOUGH AT BELLOTA

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: T.G.K.
Drawn: T.G.K.
Date: JUNE 1983



NOTES:

1. Discharge estimated above gage height of 16.00 feet.
2. Zero flow = 2.91 feet gage height.

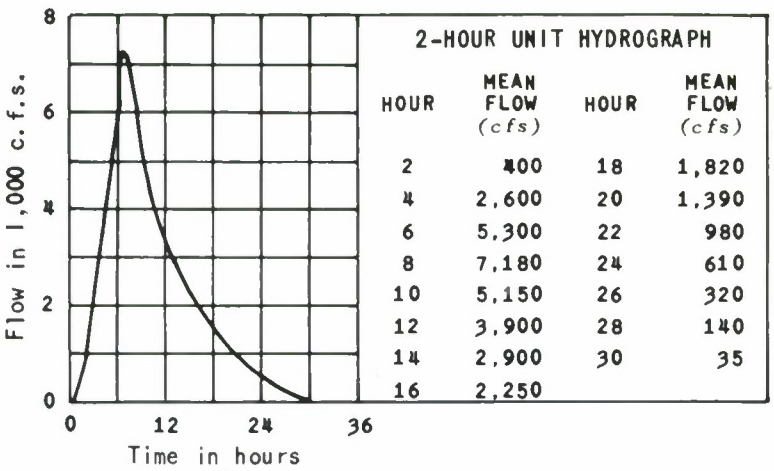
NEW HOGAN LAKE
CALAVERAS RIVER, CALIFORNIA

DISCHARGE RATING CURVE

STOCKTON DIVERTING CANAL
AT STOCKTON

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

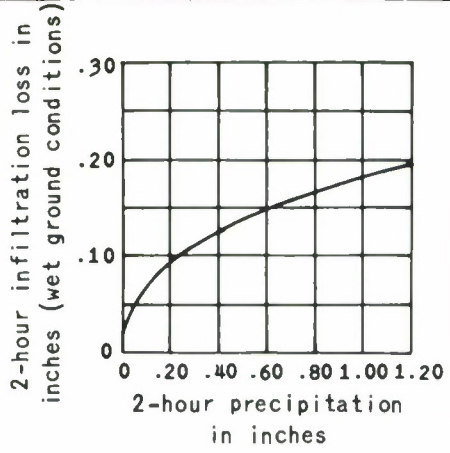
Prepared: T. G. K.
Drawn: T. G. K.
Date: JUNE 1983



2-HOUR UNIT HYDROGRAPH

HOUR	MEAN FLOW (cfs)	HOUR	MEAN FLOW (cfs)
2	400	18	1,820
4	2,600	20	1,390
6	5,300	22	980
8	7,180	24	610
10	5,150	26	320
12	3,900	28	140
14	2,900	30	35
16	2,250		

2-HOUR UNIT HYDROGRAPH - LOCAL AREA NEW HOGAN DAM TO BELLOTA



INFILTRATION LOSS - CALAVERAS RIVER

Based on: $L = .18p^{.4}$
and initial loss = 0.30 in.

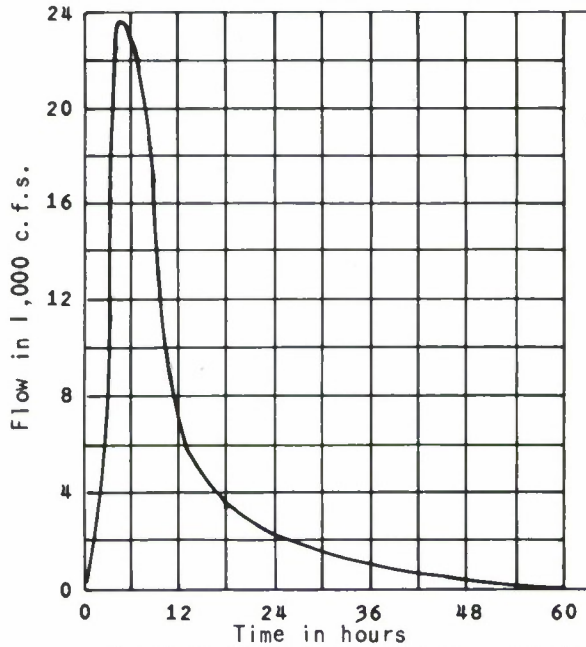
SAMPLE UNIT HYDROGRAPH COMPUTATION

DATE	PERIOD ENDING	BASIN MEAN RAIN	LOSS		EXCESS	UNIT HYDROGRAPH STRIP	RUNOFF (1,000 c.f.s.)
			INFILTRATION	SURFACE STORAGE			
1 Feb	0200	1.40	.06	.30	1.04	6,100	2
1 Feb	0400	1.90	.10	0	1.80	8,600	15
1 Feb	0600	.54	.16	0	.38	13,000	40
1 Feb	0800	.92	.07	0	.85	21,500	71
1 Feb	1000	.72	.07		.68	23,400	73
1 Feb	1200	1.77	.06	0	1.71	10,600	72
1 Feb	1400	0	0	0	0	1,600	79

As unit hydrograph strip is lowered, computed surface runoff for each position of the unit hydrograph strip is equal to the sum of the cross products of 2-hour excess and unit hydrograph values. This computed runoff corresponds to the time on the same line as the bottom of the unit hydrograph strip.

Basin mean precipitation is computed by multiplying the precipitation total of the the reporting stations for the given period by the ratio of basin average to station total mean annual precipitation, using the following mean annual values in inches:

New Hogan Dam . . . 28.0
Bell Hood Flat . . . 36.0
Sheep Ranch 42.0
Perry Ranch 18.0
Basin Average . . . 33



2-HOUR UNIT HYDROGRAPH

HOUR	MEAN FLOW (cfs)	HOUR	MEAN FLOW (cfs)
2	1,600	32	1,500
4	10,600	34	1,280
6	23,400	36	1,100
8	21,500	38	920
10	13,800	40	780
12	8,600	42	660
14	6,100	44	550
16	4,700	46	450
18	3,900	48	360
20	3,300	50	280
22	2,880	52	200
24	2,530	54	130
26	2,200	56	70
28	1,940	58	20
30	1,720	60	

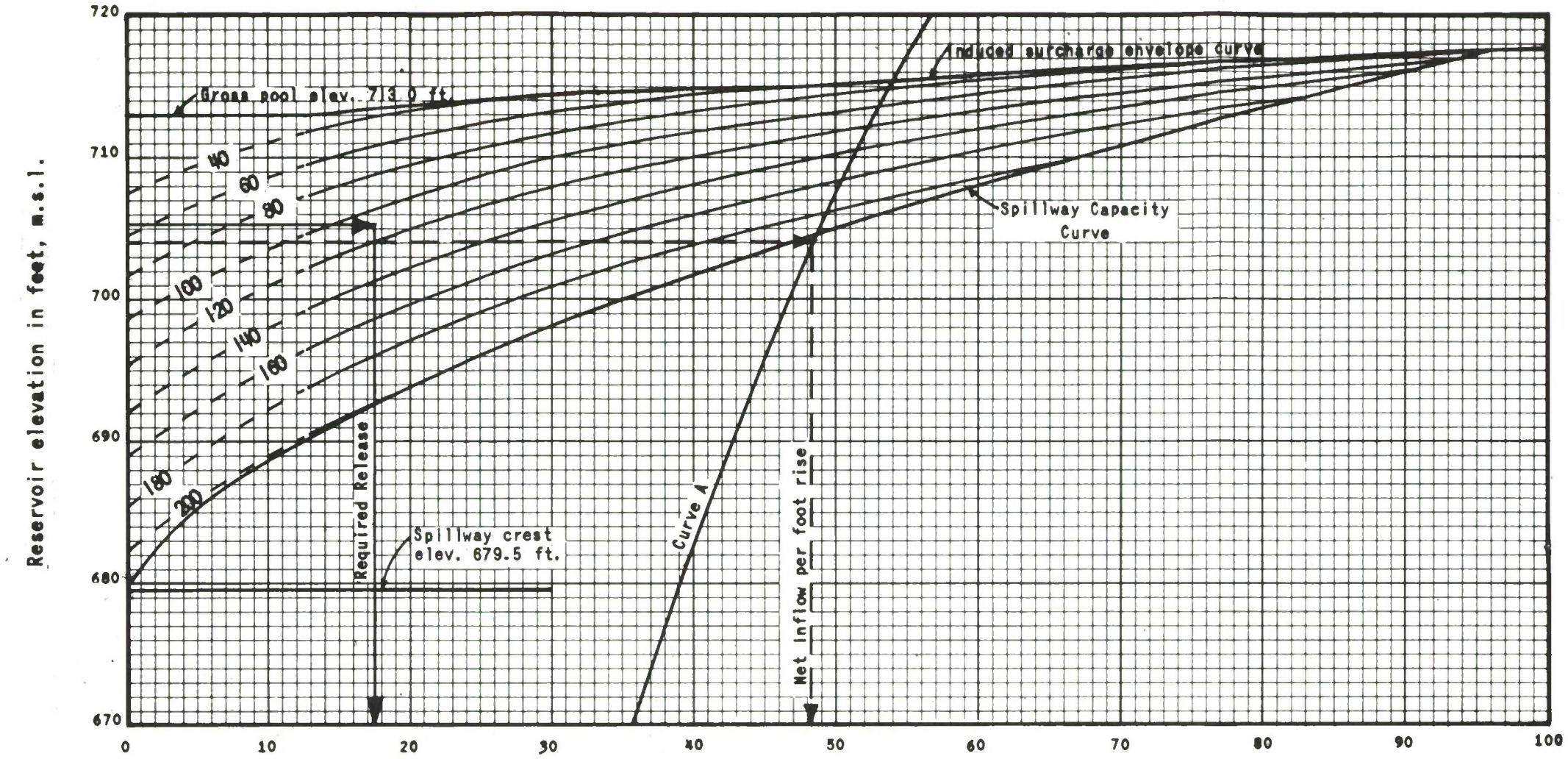
2-HOUR UNIT HYDROGRAPH - INFLOW TO NEW HOGAN RESERVOIR

NEW HOGAN LAKE
CALAVERAS RIVER, CALIFORNIA

RAIN FLOOD FORECAST CRITERIA

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: T.V.H.
Drawn: T.V.H.
Date: JUNE 1983



OPERATING INSTRUCTIONS:

1. When the reservoir is rising, read from curve "A" the net inflow per foot rise of reservoir corresponding to the average reservoir elevation during the preceding hour.
2. Multiply this value by the rise in reservoir elevation, in feet, during the preceding hour.
3. Add this product to the average outflow from the reservoir during the preceding hour. This sum is the average inflow to the reservoir during the preceding hour..
4. Adjust the outflow each hour as indicated by the parameters on the basis of the inflow for the preceding hour and the current reservoir elevation.
5. After the reservoir elevation starts to fall, maintain current gate openings until the flow has been reduced to 12,500 cfs at Bellota.

SAMPLE COMPUTATION

GIVEN DATA

Reservoir Stage at 1200 hrs	703.0 feet
Reservoir Stage at 1300 hrs	705.2 feet
Average Release	3,000 cfs

COMPUTATION OF INFLOW

Average Stage	704.1 feet
Net Inflow per foot rise (from Curve A)	48,250 cfs
Average Net Inflow (48,250 X 2.2)	106,150 cfs
Average Reservoir Release	3,000 cfs
Total Inflow	109,150 cfs

COMPUTATION OF TOTAL OUTFLOW

End of Period Elevation	705.2 feet
Required Release	17,500 cfs

NOTES:

1. Follow the flood control diagram until larger releases are required by this schedule.
2. Parameter values are the inflow to New Hogan Lake during the preceding hour.

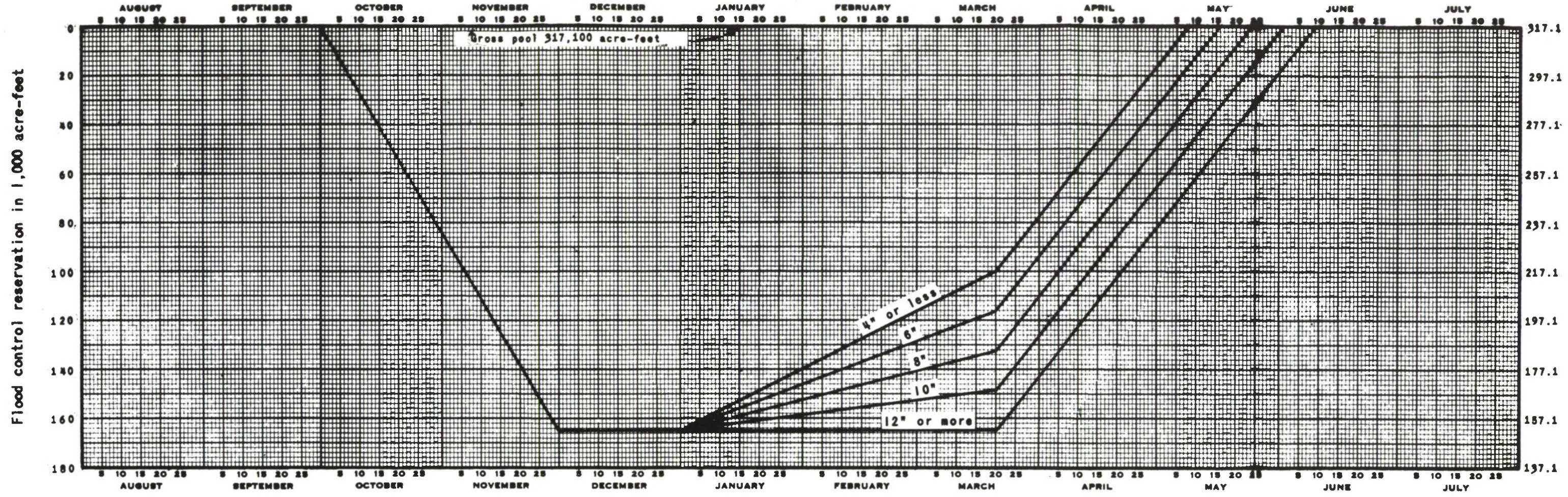
NEW HOGAN LAKE
CALAVERAS RIVER, CALIFORNIA

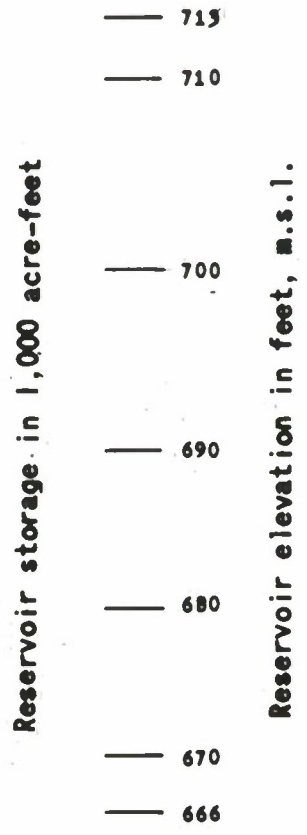
EMERGENCY SPILLWAY RELEASE DIAGRAM

CORPS OF ENGINEERS, SACRAMENTO CALIFORNIA

Prepared: R.L.L., C.J.H.
Drawn: C.J.H.
Date: JUNE 1983

CHART A-9





USE OF DIAGRAM

(1) Reinflood parameters relate the weighted accumulation of seasonal basin mean precipitation to the required flood control space reservation on any given day. Parameter values are computed daily by adding the current day's basin mean precipitation in inches to 96% of the parameter value computed through the preceeding day. (An example of the determination of required flood control space reservation is illustrated.)

(2) Except when releases are governed by the emergency spillway release diagram and the Objective Flow Schedule, all water stored in excess of that indicated by this diagram shall be released as rapidly as possible, subject to the following instructions:

(a) That releases shall be limited to such quantities as will not cause flows at Ballote to exceed 12,500 c.f.s.

(b) That releases are not changed more than 2,000 c.f.s. in any 2-hour period.

(3) That releases do not exceed the maximum rate of inflow for the current event.

EXAMPLE OF DIAGRAM USE

PRECIP STATIONS	MAP (in.)	PRECIP TODAY (P) (in.)
New Hogan Dam	24.0	1.79
Rail Road Flat	36.0	1.70
Sheep Ranch	42.0	1.40
Perry Ranch	19.0	0.60
Total	121.0(SMAP)	5.49(STAP)

Basin Normal Annual Precipitation = (BNAP) = 33"

Basin Precipitation Computation (BP)

$BP = \frac{BNAP}{SMAP} (STAP) = \frac{33.0}{121.0} (5.49)$

BP = 1.50

PARAMETER AND ALLOWABLE STORAGE COMPUTATION

Per = P + 0.96 Per'

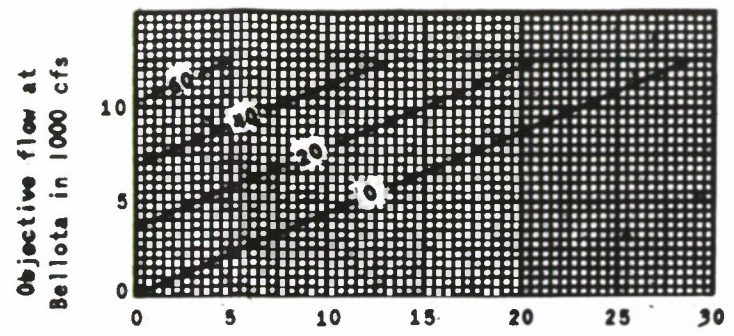
Per is today's parameter

Per' is yesterday's parameter

BP is basin precipitation

MONTH	DAY	BP	PAR'	PAR	REQUIRED FLOOD CONTROL SPACE (TAF)	ALLOWABLE STORAGE (TAF)
Sept	30	0	0	0	0	317.1
Oct	1	1.00	0	1.00	2.7	314.4
	2	2.00	1.00	2.96	5.4	311.7
	3	0	2.96	2.84	8.1	309.0
	4	0	2.84	2.73	10.8	306.3
	10	--	--	1.00	108.2	208.9
	11	2.00	1.00	2.96	107.4	209.7
	12	3.00	2.96	5.84	120.7	196.4
	13	3.50	5.84	9.11	143.6	173.5
	14	2.50	9.11	11.25	159.4	157.7
	15	0	11.25	10.80	155.9	161.2
	16	0	10.80	10.37	152.4	164.7

OBJECTIVE FLOW SCHEDULE



The parameter is the flood control encroachment in 1000 acre-feet at the beginning of the current event.

USE OF THE OBJECTIVE FLOW SCHEDULE

1. The purposes of the objective flow schedule are to minimize downstream erosion and increase carry-over storage at the end of the flood season by making releases as small as possible without reducing the level of flood protection.

2. The "current event" is the one of the following which results in the highest objective flow:
   a. The runoff resulting from rainfall anticipated within the following 24 hours.
   b. A preceeding period of rainfall and runoff which has resulted in current storage in the flood control space, but not more than 120 hours prior to the present time.

   When the current event is initially based on anticipated runoff the peak inflow criteria will change as actual flows are observed and the objective flow must be adjusted according to the actual flows. Otherwise, the objective flow remains in effect until a larger event occurs or water is completely evacuated from the flood control space.

3. When no water is stored in the flood control space at the beginning of an event, reservoir releases shall be no greater than those required to maintain the current pool elevation until flows at Ballote reach the objective flow indicated. Thereafter, releases shall be adjusted to maintain the objective flow.

4. The "flood control encroachment" is the volume of water stored within the flood control space at the beginning of an event. If the antecedent reinfall parameter currently controls the required flood control space, then the flood control encroachment volume may be based on the parameter value expected in three days considering anticipated rainfall.

NEW HOGAN LAKE
CALAVERAS RIVER, CALIFORNIA

FLOOD CONTROL DIAGRAM

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: R.L.L. Date: JUNE 1965
Drawn: C.J.H.

CHART A-10

TO: Defense Technical Information Center
ATTN: DTIC-O
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Fort Belvoir VA 22060-6218

22 October 2008

FROM: US Army Corps of Engineers
Sacramento District Library
1325 J Street, Suite 820
Sacramento CA 95814-2292

SUBJECT: Submission of technical reports for inclusion in Technical Reports Database

The enclosed documents from USACE Sacramento District are hereby submitted for inclusion in DTIC's technical reports database. The following is a list of documents included in this shipment:

ADB344304 • Lemon Reservoir Florida River, Colorado. Report on reservoir regulation for flood control, July 1974

ADB344333 • Reconnaissance report Sacramento Metropolitan Area, California, February 1989

ADB344346 • New Hogan Dam and Lake, Calaveras River, California. Water Control Manual Appendix III to Master Water Control Manual San Joaquin River Basin, California, July 1983

ADB344307 • Special Flood Hazard Study Nephi, Utah, November 1998 (cataloged)

ADB344344 • Special Study on the Lower American River, California, Prepared for US Bureau of Reclamation – Mid Pacific Region and California Dept. of Water Resources..., March 1987

ADB344313 • Transcript of public meeting Caliente Creek stream group investigation, California, held by, the Kern County Water Agency in Lamont, California, 9 July 1979

ADB344302 • Initial appraisal Sacramento River Flood control project (Glenn-Colusa), California, 10 February 1989

ADB344485 • Report on November-December 1950 floods Sacramento-San Joaquin river basins, California and Truckee, Carson, and Walker rivers, California and Nevada, March 1951

ADB344268 • Reexamination Little Dell Lake, Utah, February 1984

ADB344197 • Special report fish and wildlife plan Sacramento River bank protection project, California, first phase, July 1979

ADB344264 • Programmatic environmental impact statement/environmental impact report Sacramento River flood control system evaluation, phases II-V, May 1992

ADB344201 • Hydrology office report Kern river, California, January 1979

ADB344198 • Kern River – California aqueduct intertie, Kern county, California, environmental statement, February 1974

ADB344213 • Sacramento river Chico Landing to Red Bluff, California, bank protection project, final environmental statement, January 1975

ADB344265 • Cottonwood Creek, California, Information brochure on selected project plan, June 1982

ADB344261 • Sacramento river flood control project Colusa Trough Drainage Canal, California, office report, March 1993

ADB344343 • Detailed project report on Kern River-California aqueduct intertie, Kern County, California. February 1974

ADB344267 • Sacramento River Flood Control Project, California, Right Bank Yolo Bypass and Left Bank Cache Slough near Junction Yolo Bypass and Cache Slough, Levee construction, General Design, Supplement No. 1 to Design Memorandum #13, May 1986

ADB344246 • Redbank and Fancher Creeks, California, General Design Memorandum #1, February 1986

ADB344260 • Cache Creek Basin, California, Feasibility report and environmental statement for water resources development Lake and Yolo counties, California, February 1979

ADB344199 • Sacramento River Deep Water Ship channel, California, Feasibility report and environmental impact statement for navigation and related purposes, July 1980

ADB344263 • Sacramento River flood control project, California, Mid-Valley area, phase III, Design Memorandum, Vol. I or II, June 1986

ADB344262 • Marysville Lake, Yuba River, California, General Design Memorandum Phase I, Plan Formulation, Preliminary Report, Appendixes A-N, Design Memorandum #3, March 1977

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